THE

FOUNDRY TRADE JOURNAL

WITH WHICH IS INCORPORATED

THE IRON AND STEEL TRADES JOURNAL

VOL. 37. Thursday, November 10, 1927. No. 586.

PUBLISHED WEEKLY

Subscription Terms: 15s. per annum.
Foreign and Colonial, 17s. 6d. per annum
All Subscriptions are payable in advance.

All Communications to be addressed to the Editor, or to the Publisher, as the case may be, of

THE FOUNDRY TRADE JOURNAL,
49, WELLINGTON STREET, LONDON, W.C.2.

Telephone: Gerrard 3951 (4 lines).
Telegraphic Address: "Zacatecas, Rand, London."

Contents.

	PAGE
A Change of Focus	95
A Pressing Necessity	95
Correspondence	96
I.B.F. Section Presidents	96
Random Shots	96
Tin: A Review	97
American Foundry Practice	102
Company Meetings	102
Making Motor Cylinder Castings	103
The Estimation of Copper in Aluminium Alloys	104
National Wealth—How Produced and How We Share in It	105
A Chrome Plating Development	105
Visualising the Future of the Foundry	106
The Manufacture of Cast-Iron Tubbings for Mine Shafts	107
Problems of the Steel Trade	108
Warped Castings	108
Foundry Purchasing—XVI	109
Lancashire Junior Foundrymen Visit Sheepbridge	109
Foundry Practice and the Design of Castings	110
I.B.F. Activities in Wales and Bristol	110
Trade Talk	112
Contracts Open	112
Iron and Steel Markets	114

THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTE OF BRITISH FOUNDRYMEN; THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION, AND THE FOUNDRY TRADES EQUIPMENT AND SUPPLIES ASSOCIATION.

Institute of British Foundrymen.
PRESIDENT, 1927-28:
John T. Goodwin, M.I.Mech.E., The Red House, Old Whittington, Chesterfield.

LIST OF SECRETARIES—

General Secretary: T. Makemson, Saint John Street Chambers, Deansgate, Manchester. London Office, 49, Wellington Street, London, W.C.2.

Birmingham: F. K. Neath, 24, St. Paul's Square, Birmingham.

Sheffield: T. R. Walker, 26, Castlewood Road, Fulwood, Sheffield.

Scottish: J. Bell, 60, St. Enoch Square, Glasgow.

Lancashire: H. Stead, 1st/36, Cheetham Hill Road, Stalybridge, Cheshire.

London: H. G. Sommerfield, Charterhouse Chambers, Charterhouse Square, London, E.C.1.

Newcastle-on-Tyne: F. Sanderson, 10, Westgate Road, Newcastle-on-Tyne.

East Midlands: H. Bunting, 17, Marcus Street, Derby.

West Riding of Yorkshire Branch: S. W. Wise, 110, Pullan Avenue, Eccleshill, Bradford.

Wales and Monmouth Branch: J. J. McClelland, M.I.Mech.E., Druslyn, Bishops Road, Whitechurch, Glam.

Middlesbrough: N. D. Ridsdale, 3, Wilson Street, Middlesbrough.

Foundry Trades Equipment & Supplies Association.
President: Vincent C. Faulkner, 49, Wellington Street, London, W.C.2.

Secretary: K. S. Bridges, Avenue Chambers, Southampton Row, London, W.C.1.

Welsh Engineers' and Founders' Association.
Secretary: F. J. Griffiths, 20, Fisher Street, Swansea.

Forthcoming Events.

NOVEMBER 12.
Swansea Technical College Metallurgical Society:—Ordinary meeting at Swansea. "The Influence of the Common Elements on Iron and Zinc." Paper by J. H. Beckett.

NOVEMBER 14.
Institute of Metals (Scottish Local Section):—Ordinary meeting at Glasgow. "Brass Foundry Practice," Paper by A. Logan.

NOVEMBER 14-19.
Public Works, Road and Transport Exhibition at the Agricultural Hall, London, N.

NOVEMBER 15.
Sheffield Metallurgical Association:—Ordinary meeting at Sheffield. "Patenting of Steel," Paper by J. S. Glen Primrose.

NOVEMBER 17-26.
Commercial Motor Exhibition at the Olympia, London, W.

NOVEMBER 14-21-28-DECEMBER 5.
Royal Society of Arts:—Cantor Lectures. "Alloy Steels, their Manufacture, Properties and Uses," by Professor H. C. H. Carpenter, M.A., F.R.S.

Institute of British Foundrymen.

NOVEMBER 12.
Newcastle Branch (Junior Section):—Ordinary meeting. "Defects in Steel," Paper by H. C. Jay.
Wales and Monmouth Branch:—Ordinary meeting at Newport. "Oil Sand Cores," Paper by J. Masters.

NOVEMBER 15.
London Junior Section:—Invitation to visit the works of Messrs. Dewrance & Company, Limited, 165, Great Dover Street, S.E.1, at 3 o'clock.

A Change of Focus.

The tendency of British industrialists and politicians alike to look to America to show us a short cut to prosperity has become so obvious of recent years as to be almost a platitude. It is now beginning to appear, however, that we would do well to look a little nearer home for a more important rival and a more valuable example, and that if we keep our eyes obstinately fixed on America the facts of German prosperity will force themselves rather unpleasantly upon us, whether we will or no.

Competent observers assure us that America has no great advantage over us in the matter of men. Her standard of industrial ability in all ranks is nothing remarkable, and, indeed, it is well known that both the skilled British craftsman and the British technologist are at a premium in the States. Where America does gain is, firstly, in the extent to which she has pushed the economies of large-scale combination and amalgamation; secondly, in the genuine work-willingness of all classes; and thirdly, in enterprise.

Germany, to-day, it appears, has all this and more. She has, to begin with, the tremendous advantage of having learnt more from defeat than most of her late enemies have learnt from victory. Deprived of political and military prestige, she set herself whole-heartedly to work to achieve industrial prestige, and no one who is aware of the facts of the case will deny that she is succeeding. Strong in this determination to make good she took the American lesson to heart. Amalgamation and the sinking of the individual in co-operative effort were no new development to her; they found fertile soil and flourished. Hard work the German has never shirked, and urged on by a genuine patriotic desire for national vindication he has individually and collectively put his back into it. Of enterprise there is no lack, much of it being based on American example.

But Germany has gone still further, and this is why she has more to teach us than America. The great characteristic of German industry to-day is technical efficiency. The importance and value of scientific research, which has never had as hard a struggle for recognition in Germany as elsewhere, is freely recognised and warmly supported, and method and equipment are alike remarkably up-to-date.

Hitherto, it appears that German prosperity has been largely dependent on the home market, and especially on the demand for what may be called reconstruction goods. Now that this demand is approaching saturation point, German industrialists are beginning to look further afield for their markets, and for this reason, if for no other, we shall soon be obliged to take very serious stock of the situation. The German monopoly in certain classes of cheap goods was proverbial before the war, and is actually, if not obviously, becoming effective again; but what we have to fear is German competition in the markets of the world in regard to goods that concern us far more vitally than lead-pencils and china dolls. With the economies that result from amalgamation, enterprise, and hard work, coupled with the improvements yielded by widespread and adequately supported scientific research, German goods are rapidly approaching the point at which they will affect us in this country very seriously indeed. The quality of our goods is such that we can hold our own with America in everything except the great mass product industries, and even there we are beginning to usurp attention. What we have to fear from Germany is not merely mass production methods, but the combination of high quality with low price.

A Pressing Necessity.

There seems to be a fair amount of misapprehension as to the scope of employers' federations amongst the operatives in the foundry industry, and propaganda is necessary to dispel these erroneous impressions. Only two functions are generally emphasised and often exaggerated. They are the regulation of wages and the maintenance of selling prices. Actually, the duties of the modern employers' organisations are much sounder and wider. They can be defined as a co-operative movement to secure efficiency in any industry with the object of lowering prices to the consumer. For the furtherance of this objective it is essential that profits must be made for the industry as a whole in order that money is available for procuring the best type of plant and machinery. We are in position to assert that British industrialists do know exactly what they require for modernising their works. They have followed with interest the new plants erected on the ruins in the North of France left by the war. They are cognisant of the brilliant examples of foundry layout in new British foundries, usually catering for comparatively fresh industries, but they are only too well aware of the extreme difficulty of attracting outside capital. New money for the industry must be created by the industry for the industry, and this is undoubtedly realised by the more enlightened employers who do not receive the support they deserve.

To accomplish this desirable object of creating adequate wealth for the industry the following process suggests itself. Primarily there should be one big association for every manufacturer of iron, steel or non-ferrous castings, which would be sectionalised, not geographically, as in foreign countries, but rationally, according to nature of output. The subjects to be dealt with would be first, the imposition of a unified costing system to kill unfair competition, then committees would be formed to treat with the Home Office, railway companies, and rating authorities; to advise on both scientific and industrial research; to effect reasonable standardisation, where possible, and

finally, to collect the essential statistics for utilisation within the industry. It seems a colossal task to organise the 3,000 iron foundries alone, but remembering that the industry automatically divides itself into a number of groups, the major difficulty disappears.

The weak point in the above scheme is that prominent foundry owners, who have already devoted so much time for the general benefit of the trade, are finding, that owing to the last seven lean years, they have not the time available. Their enthusiasm and public spirit, however, ought to encourage the younger generation to emulate and expand the tenets they have for many years so ably expounded.

Correspondence.

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

Controlling the Price of Tin.

To the Editor of The Foundry Trade Journal.

Sir,—In "Trade Talk" in your issue of October 27 you refer to "an extraordinary report in regard to an alleged meeting of tin producers" held with the object of discussing plans whereby the price of tin might be controlled. That the meeting referred to took place no one who is in touch with the tin world can doubt, and it may interest you to know that it has been followed by other meetings, and that discussions are still taking place which have as their object the formulation of a scheme which shall effectively stabilise the price of tin over a reasonably long period ahead, and so free the market from those very upsetting fluctuations which have done so much to restrict business during recent years.

You go on to say that while no definite information is available, it is quite safe to state "that such a scheme has not the slightest chance of success." Your views, it may interest you to know, are in direct opposition to most of the important tin producers in a country who, to-day, while they are not in a position to make any definite announcement on the subject, believe that the scheme on which they are working has every prospect of success.

For reasons which I am sure you will appreciate, I am unable to sign this letter for publication, but I can assure you that the facts are as stated.—Yours, etc.,

Tin Producer.

London, W.C.
November 8, 1927.

[Our correspondent appears to be labouring under a slight misapprehension in regard to our remarks on the price-stabilisation scheme. We are well aware that the meeting referred to took place, and that the suggestion is still under consideration, but unfortunately this journal represents interests that are widely divergent from those of the tin producers. The foundries are consumers of tin in many forms, and, despite the obvious inclination of producers and speculators to reap even a more fruitful harvest in the future than they have done in the past, we are afraid that we shall never be convinced that stabilising the price of tin at the "modest" level of £300 will tend to remove the severe depression from which the foundry trade in many branches has suffered for several years. Our argument that the scheme had no chance of success was not based on the assumption that the producers would find the initial difficulties of price stabilisation insurmountable, but on the commonsense view that no industry can afford to pay more for its raw materials than the world price for its finished products warrants. Immediately an article becomes too dear its usefulness vanishes, and it is not a very difficult matter to provide substitutes. Fortunately, or unfortunately for the tin producers, they have other and more important interests than the foundries to consider. The tinplate industry of the world, principally, of course, in Wales and America, is a heavy consumer of tin, and it is undoubtedly a very unpalatable fact for the tin producers and speculators to digest that a large proportion of the depression, unemployment and distress in that industry can be rightly credited to the high price of tin, not to mention the numerous complaints in recent months regarding the alleged inferior quality of the tin coating. We are not admitting that the quality of Welsh tinplates has deteriorated, but if there is any substance in the complaints at all, it is certainly due to the high cost of the tin. When it is recollected that tinplates at 18s. per box are less than 30 per cent. above pre-war, and that tin at £300 would be approximately 114 per cent. higher, it does not appear to us that such a scheme would have a very successful issue. It would probably go the way of all other price-maintenance schemes. The key to the anomaly that tin consumption in recent years has been stationary while that of other metals has increased is not price stabilisation but increased production. Let more tin be produced, and the white metal become plentiful and cheap, and then see whether the consumption of tin will lag behind its sister metals. Finally, our advice to the tin producers is, try the effects of a little publicity.—Ed., F.T.J.]

I.B.F. Section Presidents.

No. 3—East Midlands Section.

Mr. H. Pemberton fully deserves the honour bestowed on him this year, as he is one of the oldest members of the Institute. He joined it some 21 years ago, and for the last 18 years has been a member of the General Council. Originally he was attached to the Birmingham Section, and was actually a vice-president of that

Mr. H. Pemberton

Branch. Later, he called a meeting at Derby, and created what is now known as the East Midlands Section, he being elected its first honorary secretary. Mr. Pemberton has been extremely active, and read Papers in practically every important ironfounding centre in Great Britain. For the last 22 years Mr. Pemberton has been head foreman of the iron foundry in the C.M.E. Department of the Derby Locomotive Works of the London, Midland and Scottish Railway. He studied metallurgy and chemistry at Derby Technical College.

Effects of Electrical Arcs on Inflammable Mixtures of Gas and Air.—Mr. G. Hibberd has submitted to the University of Glasgow as a thesis "An Investigation into the Effects of Electrical Arcs on Inflammable Mixtures of Gas and Air." His results and conclusions are summarised in 13 paragraphs. At the end of his thesis the author makes two recommendations, namely, that (1) broad flanges with a gap between them should be provided at all joints, and (2) cast-steel casings are preferable to those of cast-iron unless the latter are strengthened by webs.

Random Shots.

Already this place and that is being mentioned as the possible destination of next year's meetings of our various itinerant societies, and the question of locating meetings abroad recurs. A number of the British technical institutions frequently arrange to hold their annual meetings in foreign centres, and certainly the result is an extremely interesting and valuable meeting—for those who can go. But inevitably such an arrangement cuts out the younger members, who can for the most part afford neither the time nor the money required, and one cannot help feeling that the result is a complete change of character—a temporary one, it is true, but none the less complete. Particularly does this affect those societies whose annual meetings are by way of providing a forum for the presentation and discussion of Papers by the younger members. The popular alternative, that of holding the meeting at home and at the same time encouraging members to attend the meetings of kindred or associated bodies abroad has much to recommend it, although it will of necessity appeal to an even narrower group, since it is not everyone who can spare time for two affairs so similar in character.

* * *

In this connection, an outline of the itinerary for next Spring's Spanish trip was displayed at the Paris Exhibition, and it looked exceedingly attractive. But Spain is a long way off, and to the mind's eye the distance is enormously magnified, since one does not hear of Englishmen visiting Spain, whether on business or pleasure, with the frequency with which they go to France, to Germany, even to Italy. This is possibly due to the length—or fancied length—of the journey, and to the poor accounts one hears of rail connections in that country. Of recent years, however, Spain has been growing in popularity with English travellers, and for those who can manage it there can be no doubt that the trip will be a wonderful experience. But we are led to suspect that the lucky ones will be a very select few when it comes to the point.

* * *

Commenting last week on the future of dog-racing, I am reminded that the Borzoi is to be trained to race. . . . What next? In France the Borzoi is the lady's dog "par excellence," although he shares his popularity with those unpleasant little black wiry beasts that disport themselves inconsiderately and offensively at every French summer resort. . . . And so if the Borzoi is to chase the electric hare, what is to prevent the training of Poms, Pekingese, and other favourites of the fair sex in this country? Certainly it would lend variety and humour to the otherwise rarified and reverential atmosphere that at present pervades the haunts of the greyhound.

* * *

So many and so varied are the inquiries that come our way that we have this week sorted out a number dealing with the same type of problem, and have been fortunate enough to secure the assistance of an eminent ironfounder of many years' experience in drawing up the answers. Here they are:—

To "Foreman," South Wales.—Specialists agree that the preservation of a luxuriant growth of hair depends upon the living of a simple and abstemious life, and the avoidance of high temperatures of any description. If you observe these conditions carefully you will find that your tendency to baldness will disappear.

To "Moulder," Essex.—We have found by long experience that the surest method of avoiding coarsening of the skin and enlarged pores is to coat the exposed portions of the body, and especially the face, thickly with axle grease before commencing work. If this is too expensive, a liberal application of ordinary foundry blacking makes a good substitute, although it does not suit all skins.

To "Foundry Manager," Sheffield.—You state that you are troubled by the threatened loss of your youthful figure. We fear that you do not take enough exercise, and would suggest that you transfer your activities to some less sedentary occupation. Hard work and plenty of physical and mental exercise are the best preventives in such a case.

Marksman.

TIN: A Review.

Treating of its History; Occurrence; Mining; Smelting; Properties; Uses; Reclamation; and Future.

(A Specially Contributed Supplement to The Foundry Trade Journal.)

Foreword.

"Tin Rises," "Tin Falls," "Tin Active," "Tin Dull," "Tin Soars," "Tin Crashes," "Tin Strong," "Tin Weak," "Tin Firm," "Tin Yields"—these and suchlike newspaper headlines, denoting day by day the various phases in the market transactions relative to tin, are familiar to all readers of The Foundry Trade Journal. As to why tin and tin shares loom so largely in the commercial columns of our newspapers, and the reason for the constantly recurring sensational fluctuations in the price of tin, is perhaps a matter of wonderment to many, and maybe some pretty juggling at the expense of the users of tin is often suspected. The true explanation lies in the fact that it happens, not infrequently, that the world's demand for tin for industrial purposes is for some short period much in excess of the world production of the metal, and such stocks of tin as may be in hand at these periods of insistent demand are occasionally reduced almost to vanishing point; hence the high prices which at times prevail. In round figures, the world's tin production during the last few years may be reckoned as being between 120,000 and 140,000 tons per annum, whereas the world's consumption of tin to-day is at a rate actually in excess of the larger figure by many tons. It has been said that "Tin once used is practically lost for ever," the reclamation of used tin being only possible to a very limited extent. It is thus obvious that although a price of £140 per ton represents the average cash price of standard tin per ton over the last fifty years, the demand for the metal in later years has become a steadily increasing one, and the law of supply and demand asserts itself and is responsible for the price of tin soaring up, on occasions of urgent demand, to as much as three times that of the average price before mentioned. During the latter years of the last century it was exceptional to find the cash price of standard tin exceeding £100 per ton; since then, however, there has been an upward tendency, which there is every reason to anticipate is likely to persist. It would be very difficult to give even a vague estimate of the enormous amount of capital which has been expended on the tin industry as a whole. Further immense sums of money will have to be spent, more intensive scientific explorations and surveys conducted, and more economies in the present-day working effected, in an endeavour to meet the ever-increasing demand for tin.

The stocks of tin are to-day very much lower than those previously maintained. Five years ago the world's stocks were estimated as 50,000 tons, at that time equivalent to about six months' consumption. The stocks at the end of August last were estimated at less than 14,000 tons, equivalent at the present rate of consumption to from five to six weeks' supply only, notwithstanding the very considerable production of the metal which has prevailed throughout the period covered. Quoting from some notes recently handed to the writer, "Tin is to-day the only metal in common use that producers experience the least difficulty in supplying in sufficient quantities to meet the requirements of the consumers, although at a relatively high price compared with other common metals both from the standpoint of producing costs and former values."

Historical.

Tin was one of the few metals known to ancient peoples. The very early Chinese writers only recognised five metals, designated "The Five Metals," and of these five metals tin is one. Of the six metals mentioned in the Old Testament, tin finds a place in the Book of Numbers, xxi, 22, the metal being included in the spoil of the Midianites; again, in the Book of Ezekiel, xxvii, 12, reference being made to tin coming from Tarshish, in Spain. It is interesting to recall in connection with these Biblical references that according to some writers the Phœnicians, at a date even more remote than the building of King Solomon's Temple, were bringing tin from Cornwall and were trading in this metal amongst the peoples of the ancient world, probably as long ago as 1,500 B.C. Through these ancient traders, these writers affirm, Britain became known as the Cassiterides or Tin Islands; the mineralogical name of the ore, cassiterite, from which the bulk of metallic tin has always been obtained, being derived from the above naming of Britain by these renowned and worthy traders. Later investigators, however, regard as entirely mythical this story of the Phœnicians coming to Cornwall to obtain their tin. Cornwall, they assert, was an almost uninhabited and desolate land until the Romans invaded England and drove the Celts into the western counties. According to these same authorities, the Cassiterides were islands off the coast of Spain. It is now advanced that various localities mentioned by the earliest writers as the source of tin supplies were purely fanciful, and were invented by the wily ancient tin traders in order to conceal the true source of tin, which probably came from Galicia and North-Western Spain.

The early history of the Cornish tin mining industry is lost in obscurity. One of the first important records is a mention occurring in a letter written in 1198 by William de Wrotham, Warden of the Stannaries (Tinneries), to Hubert, Archbishop of Canterbury, and Chancellor of England.

In early times tin was considered to be Royal property. The Stannaries were the tin works generally, and were leased to private individuals, who paid very high sums to the Crown for the privilege of working the mines. King John made tinners answerable only to the Chief Warden of the Stannaries, and not to their real feudal lords. Tin Stannary Courts were instituted to try any cases of dispute arising in connection with tin production. Shaft-mining for tin in the Cornish era was probably started in the fifteenth century.

Much has been said in recent years of the lost art of hardening copper. It is very doubtful whether there is any lost art. Copper can certainly be hardened by cold work, such as rolling or hammering, but by the admixing of copper and tin in the molten state alloys result which are of very considerable hardness. It is in connection with ancient alloys of this character, founded in the first instance possibly by prehistoric metal workers, whether of purpose or accidentally, that one must accept as probably being the most ancient employment of tin, and incidentally the art of hardening copper. Certain very early but well-preserved bronzes, dating as far back maybe as 4,000 years before the commencement of the Christian era, are assumed to have resulted from the direct smelting of tin-bearing copper ores, but this assumption is open to question, not only on account of the extremely rare occurrence of ore of such character, but more particularly in view of the fact that quite recent discoveries have proved beyond question that metallic tin was known to these very ancient workers in bronze, the inference therefore favouring the purposeful alloying of the two metals, copper and tin.

"In hissing flames huge silver bars are roll'd,
And stubborn brass and tin and solid gold."
(Homer's "Iliad," xviii.)

Occurrence of Tin.

Native tin is of very rare occurrence, and to all intents and purposes it may be taken that so far as relates to the mass of the world's production of tin at the present time, there is only one ore from which the metal is derived, namely, tin-stone, the mineralogical name of which, as previously mentioned, is Cassiterite. This mineral may and often does occur almost pure, in which case it is an uncontaminated oxide of tin—stannic oxide—a compound consisting of one atomic part of tin combined with two parts of oxygen. The specific gravity of Cassiterite is 6.4-7.0, and in a state of purity the mineral carries 78 per cent. of tin. It occurs in mineral lodes as *vein tin* and in alluvial deposits as *stream tin*, the latter being generally the purer of the two forms. Cassiterite is not an abundant ore and has only been discovered and worked in paying quantities in very few countries. A glance at the map, Fig. 5, showing the tin-producing countries of the world leaves one wondering whether, in view of the prices prevailing for the metal, sufficient recent prospecting work has been undertaken in other countries. Penang, an island off the west coast of the Malay Peninsula, and Singapore and Malacca, both on the Peninsula itself, producing the well-known Straits tin of the Federated Malay States (F.M.S.), Banka Island and Billiton Island of the Dutch East Indies, Cornwall in the south of England, Bolivia, Australasia, China, Nigeria in West Africa, Burmah and Siam, practically exhaust the identity of the countries from which the world's supply of tin-stone is obtained. Best part of the tin in Nigeria and the Far East is derived from secondary alluvial and eluvial deposits. It is interesting to note in passing that approximately forty-five per cent. of the world's production of tin is won within the British Empire. The Bolivian ores, which latterly have somewhat declined in richness, will undoubtedly in the near future become enriched by further developments in that country's tin resources, whereas some of the older sources of supply in other countries are nearing exhaustion, and fresh fields are badly wanted. The following figures recently published show at a glance the localities from which is drawn the world's supply of tin and the respective percentage output from each country:—Far East, 63; Bolivia, 21; China, 5; Nigeria, 5; Cornwall, 2; Australasia, 2; and other countries, 2 per cent.

Mining of Tin Ores.

There are several methods of mining tin ores, the adoption of any particular method depending largely upon the location, class of deposit, labour and water supply. The principal methods are (a) shaft-mining, (b) open-cast mining, (c) gravel-pumping, (d) hydraulicing, (e) dredging, (f) ground-sluicing, and (g) panning.

Shaft-mining may be likened to coal mining as usually visualised by the lay mind. Shafts are driven down through the surface soil until the tin bearing strata is reached, the tin rich earth being hoisted to the surface and treated above ground.

The actual separation of the tin-stone may involve the crushing of the tin-bearing earth between the jaws of powerful rock-breakers or under stamps; in the latter method a heavy falling tup, actuated by cam motion, smashes the ore as it is fed on to an anvil. Powerful mills further reduce the rock to a more or less fine powder, from which the heavy tin stone is separated by washing away the lighter tin-free minerals.

In open-cast mining, as the name indicates, the ore is delved from the open ground, thus forming a more or less crater-shaped hole, which is enlarged and grows deeper as the work of delving proceeds. Although somewhat primitive, this method of mining is largely employed where the nature of the ore deposit permits. Both hand labour and mechanical grabs and excavators are

employed as may be expedient. Terraces are sometimes cut, work proceeding simultaneously at different levels. In those localities where native labour is cheap and abundant, and other things being favourable, open-cast mining leaves little to be desired. Drainage problems have necessarily to be overcome, and carrying or haulage in the case of deep workings must be legislated for on the most economic lines. Hand carrying, trucking or tramming and hoisting are the methods generally adopted.

Gravel-pumping necessitates a plentiful supply of water, and this being assured the ore-bearing earth is mixed with water until the condition of the mass is such that it can be pumped out and delivered at a higher level for further treatment.

The method of mining by hydraulicing somewhat resembles the familiar sight of a fireman playing a hose on a fire. The water leaving the nozzle at a high pressure is directed to the bank of earth, and by virtue of its force break it down, thus rendering it suitable either for dredging or gravel-pumping. In hydraulicing two or more pumps are generally installed, often mounted on a pontoon, one for pumping the water for the breaking down jet and one for elevating the earth as in gravel-pumping. The motive power driving the pumps may be either steam or electricity.

Dredging as a method of mining is one very commonly used. Steel buckets are employed. The ore-bearing deposit is broken up and the low-lying machines are power driven, the nature of the power used depending upon local conditions.

A combination suction cutter dredger is employed in some fields. This combination consists of a propeller-shaped cutter two to four feet in diameter mounted at the free end of a strong flexible shaft. The act of revolving under water causes the cutter by its own weight to cut up the ground upon which it rests, and the loose earth in the hole thus formed is sucked up through a pipe by gravel pumps as before mentioned. This method is not applicable to earth having a heavy tenacious clay bonding.

Ground sluicing is a further means of mining and winning of tin ore. As the name implies, the broken earth is shovelled or conveyed to long

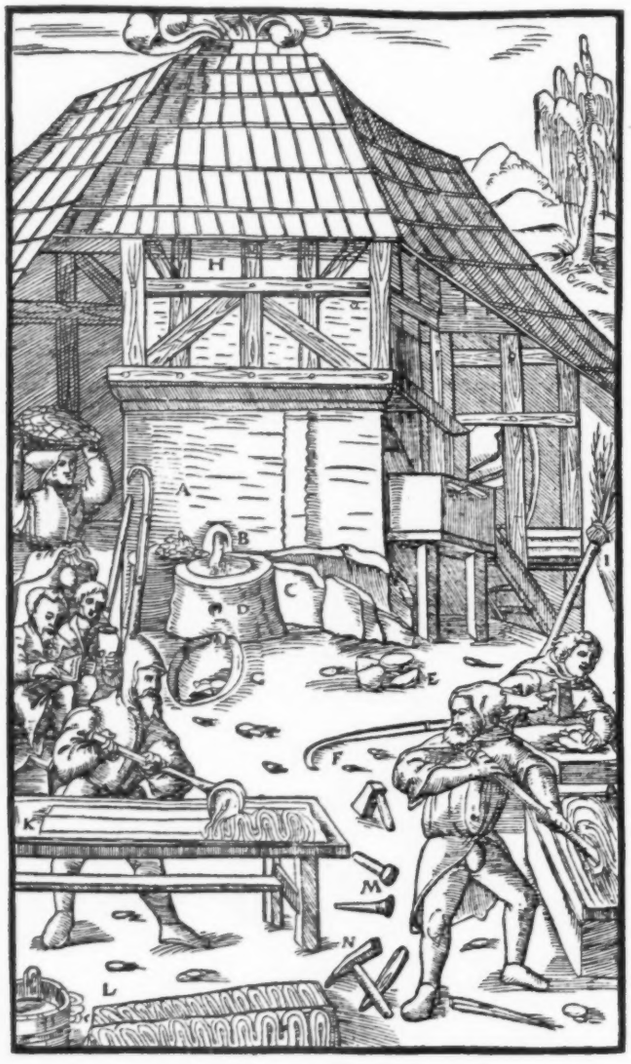


Fig. 1—A—Furnace. B—Its Tap-hole. C—Forehearth. D—Its Tap-hole. E—Slags. F—Scraper. G—Dipping Pot. H—Walls of the Chimney. I—Broom. K—Copper Plate. L—Lattice-work Bars. M—Iron Seal or Die. N—Hammer.

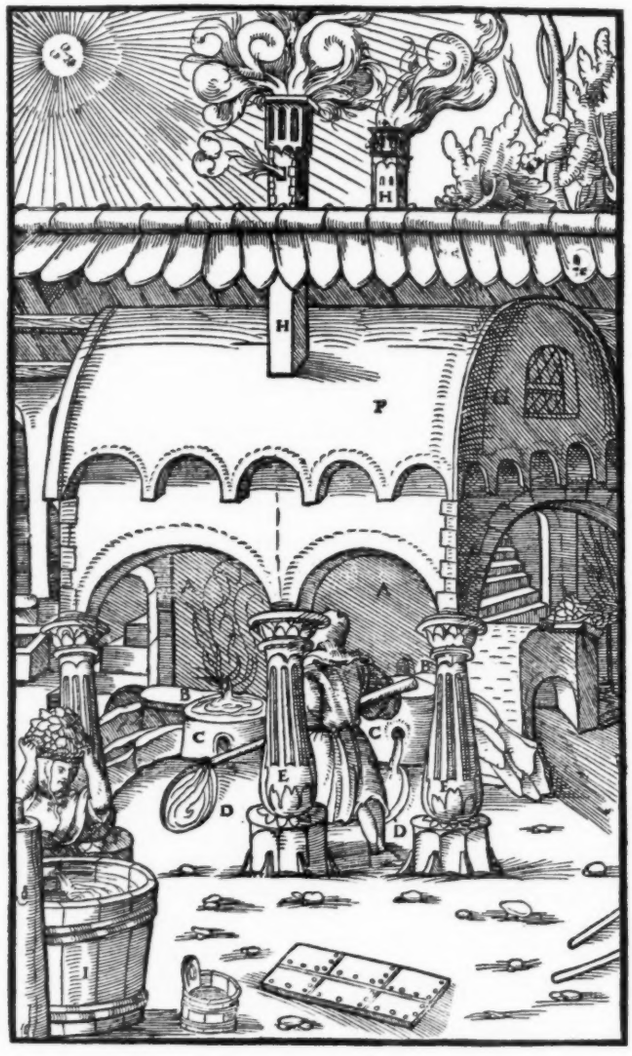


Fig. 2.—A—Furnaces. B—Forehearths. C—Their Tap-holes. D—Dipping Pots. E—Pillars. F—Dust-Chamber. G—Window. H—Chimneys. I—Tub in which the Coals are Washed.

As may be expected, the wear and tear on the pumps is very severe, and the cost of maintenance correspondingly heavy.

Hydraulicing calls for water under pressure, either natural pressure due to a head of water derived at a height considerably above the tin workings and conveyed thereto in a suitable pipe or channel, or to artificial pressure obtained by mechanical means, the latter only being an economic proposition when cheap power is available and the spent water is employed also to afford a means of rendering the ore-bearing earth suitable for elevating by gravel-pumps.

earth is elevated in the buckets by means of a moving endless chain in the method commonly observed in ordinary dredging operations in docks, rivers, etc. The ore is evacuated from the steel buckets into sluice-boxes, the concentrates being retained and the residue discharged, the latter if necessary being subjected to further treatment. The buckets in descending below the water dig into the ground and are automatically filled as the operation of the dredger continues. The length of the ladder carrying the chain and the slope of same determines the depth of working and the quantity of the earth lifted. Dredging

trenches or sluices in which a strongly-flowing current of water serves to concentrate the ore by washing off the lighter earth, leaving the heavy rich tin-bearing mineral in the upper portion of the channel.

Panning is a primitive and simple yet effective method of concentrating ore found in broken loose clay-free gravel. The "pan" is merely a large shallow dish of either metal or wood. A quantity of the ore-bearing gravel in a fine state of division is introduced into the pan together with a sufficiency of water, and by a dexterous swirling motion the lighter portions of gravel, rock, etc.,

are swept out of the pan, thus leaving in time a rich concentrate of the heavy tin-bearing mineral as a residue in the pan. Cheap labour, male and female adults, and even children being able to control the pans which, being supported in water, are comparatively easy to manipulate.

Smelting.

The smelting operation employed in winning tin from its ore, so far as the basic chemical reactions are concerned, is very simple. It is only necessary to heat the concentrated ore in contact with carbon or some other reducing agent, metallic tin resulting. As may be inferred, however, from previous statements, the tin-stone from which the bulk of the world's tin is derived is usually associated with other mineral matter, either mechanically admixed with the tin-stone, or in combination therewith, and this being so, what would otherwise be a simple smelting process becomes a little more involved. Both arsenic and tungsten, for instance, are often associated with tin-stone, and the presence of these two impurities necessitates a preliminary roasting of the dressed ore to remove the arsenic, and a process of smelting with alkaline salts to convert the tungsten to a soluble salt, followed by "leeching" or washing to remove that salt in order to separate the second impurity. The dried partially-purified tin oxide is then reduced to metallic tin on the hearth of a reverberatory furnace by heating with carbonaceous matter—usually either charcoal or anthracite—and further purified while in the molten state by stirring the metal with wooden poles, thus causing the impurities to become oxidised and to rise to the top of the molten tin. After removal of the top portion the metal is skimmed clean and the pure tin ladled out and cast into marketable form. The smelting of tin in more primitive times was conducted essentially as above described. The liquid metal as freed ran down the sloping bed of the reduction-hearth, and flowing through an open tap-hole collected in the fore-hearth—a rectangular-shaped receiver—this, in turn, was tapped at intervals and the metal transferred to a dipping-pot, and thence by means of dippers or ladles and cast into shapes. The electrolytic refining of tin is of recent introduction and only within the last decade has this process been worked as a commercial undertaking.

In the smelting process outlined above, although only apparently a crude method of refining by fire, yet by the use of fluxes to assist in the elimination of impurities, a high degree of purity is certainly obtainable when operating with the purer ores, but with the product of the more impure minerals, electrolytic refining finds its justification. The electrolytic process will take care of the more or less impure material derived from concentrates of contaminated ores, concentrates which otherwise would be difficult to handle successfully.

Mechanical and Physical Properties of Tin.

Tin, the chemical symbol of which is Sn, from the Latin, *Stannum*, is a silvery-white lustrous metal with a slight bluish tinge, and when pure, is very malleable at ordinary temperatures, but of low tenacity and ductility. Tin is very rarely found in the "native" condition, that is, as free metal uncombined with non-metallic elements. Commercial refined tin may have a very high degree of purity, some brands assaying 99.95 per cent. of tin. The metal has a specific gravity of 7.29, which, together with its low fusibility, serves to distinguish it from silver. It is particularly immune to corrosive effect when exposed to conditions under which many other metals become badly corroded and unsightly. It is the most easily fusible of the common metals, melting at 232 deg. C., and volatizes between 1,500 and 1,600 deg. C. On account of its malleability at ordinary temperatures tin can be readily hammered or rolled out into extremely thin foil. When heated to 100 deg. C. it may be drawn into wire. At a little above 200 deg. C., however, it is so brittle that it may be broken into small pieces and may be ground to powder. It exhibits a fibrous fracture when broken at ordinary temperatures, and a stick of the metal upon bending emits a peculiar cracking sound—the well-known "cry" of tin. At low temperatures the metal disintegrates to a coarse crystalline powder. Tin is harder than lead, but softer than zinc. The most usual impurities found in commercial brands of tin are lead, antimony, copper, bismuth, arsenic, sulphur, iron, and zinc. The Table I gives the approximate analysis of many well-known representative brands and grades of the metal.

The London Metal Exchange requirements of a standard tin include a tin content of not less than 99.75 per cent., and that the metal stands up to a bend test. The following are good delivery on the London Metal Exchange:—Straits, Australian, Banka, Belgium, Billiton, English, American, German and Chinese tin.

Uses of Tin.

Round about 40 per cent. of the world's total consumption of tin must be put to the credit of the tin-plate industry. The great demands, both of the canning industry for containers of tin-plate for petroleum, oil, foodstuffs, industrial and domestic commodities, and the ironmongery trade for kitchen and other articles of tin-plate is an ever-increasing demand. The great advantages in the use of tin-coated plate in the canning industry is that tin neither affects the contents of the cans, nor is it affected thereby, also that it facilitates the soldering process employed in building up and sealing the containers. Mention of soldering as a means of joining tin-plate prompts the statement that over 20 per cent. of the world's total consumption of tin goes to the making up of the solders used by plate workers, plumbers, linesmen, instrument makers, toy-makers, and other craftsmen. In the manufacture of tin-plate carefully annealed thin sheet-iron or mild steel sheets, from which all scale and grease has been removed by immersion in suitable "pickling" baths, followed by washing and drying, are introduced into a bath of molten tin, the surface of the molten metal being protected by a fatty oil or grease. Suitable fluxes, among which zinc chloride is very popular, are employed to ensure the requisite adhesion of the tin to the surface of the ferrous plate. Means are taken to ensure a uniform thickness of coating on plates of the same grade, as well as a uniform thickness of tin over the whole surface of each plate. The gauge of the ferrous plate, the thickness of the coating of tin, and the quality and composition of the coating are determining factors governing the marketable value of tin-plate. Terne-plate is an inferior quality of tin-plate, the composition of the coating in some instances containing only 20 per cent. of tin, the remainder being principally lead. Terne-plate, on account of this high percentage of lead, is unsuitable for the canning of foodstuffs, or for the manufacture of domestic articles likely to be brought into close contact with food. For the tinning of vessels of copper, such as vats, tanks, etc., brewing, sugar-boiling, and like containers, and stills, pots, pans, kettles, etc., pure tin is used, together with one of the suitable fluxes, the best of which perhaps is zinc chloride ("killed spirit of salt").

The so-called antifriction whitemetals of the babbitt type, in great demand as a lining metal for bearings where the use of solid bronze or ferrous metals is not considered desirable, is responsible for the third largest percentage consumption of tin. These antifriction whitemetals vary very much in composition, ranging from lead-base metals, in which lead predominates, and the content of tin is perhaps below 10 per cent., to those of the tin-base class, in which the tin content is as high as 90 per cent. and even slightly in excess of that figure. This latter type is in much request in the automobile and aircraft

Table I.—*Approximate Analyses of Tin.*

Below are approximate average analyses of representative brands and grades of Tin.

	Sn.	Sb.	As.	Pb.	Bi.	Cu.	Fe.	Ag.	S.	Co.
Banka	99.950	.007	Nil	Trace	Nil	.018	.045	Nil	Trace	
Billiton.. ..	99.960	.006	Nil	Nil	Nil	.023	Nil	Nil	Nil	
Penang ..	99.939	Trace	.013	Trace	Nil	.016	.028	Nil	.004	
Singapore ..	99.870	.008	.045	.034	.003	.052	.003	.006	.005	
Mt. Bischoff* ..	99.795	.015	.063	.037	.005	.035	.042	Trace	.008	
Pyrmont ..	99.938	.017	.019	Trace	Nil	.022	Trace	Nil	.004	
Irvine Bank ..	99.580	.062	.034	.221	.025	.126	.002	.018	.004	
Williams, Harvey, No. 1 ..	99.860	.015	.040	.004	.005	.047	.003	Nil	.006	
Williams, Harvey, No. 2 ..	99.560	.166	.037	.166	.007	.050	.005	Trace	.013	
Williams, Harvey, No. 2a ..	99.350	.245	.065	.223	.015	.042	.016	Trace	.013	
Williams, Harvey, No. 3 ..	99.200	.300	.037	.396	.007	.100	.013	.014	.006	
Williams, Harvey, No. 4 ..	99.941	.011	.022	Trace	.001*	.020	Trace	Trace	.005	
Penpoll, No. 1..	99.720	.118	.054	.041	.007	.052	.004	.009	.007	
Penpoll, No. 2..	98.710	.569	.042	.546	.035	.103	.007	.015	.004	
Penpoll, No. 3..	99.300	.325	.056	.212	.050	.088	.002	.021	.009	
Redruth ..	99.160	.176	.053	.177	.017	.445	.041	.006	.008	.012
Sutton, T., and Sons, Ltd. ..	99.550	Trace	.022	.342	.015	.045	.010	Trace	Nil	Traces & loss
London Tin S. Co., refined ..	99.921	.022	.013	—	—	Trace	.030	—	.004	
G. T. Holloway	99.76	Certified	G.M.B.							
Thames Metal Co.	99.17	Certified	G.M.B.							
Th.Goldschmidt, No. 1 ..	99.860	.004	Nil	.102	Nil	.043	Trace	Nil	Trace	.016
Th.Goldschmidt, No. 2 ..	99.460	.015	Nil	.425	Nil	.069	Trace	Nil	Trace	
Th.Goldschmidt, No. 3 ..	99.150	.122	.046	.143	.112	.352	.007	.006	Trace	
Union Minière du Haut Katanga ..	99.907	.012	.025	.020	.001	.011	0.11	Trace	.005	.003
O. T. Lemprière & Co., Australia	99.880	.011	.016	.019	.012	.026	.020	Nil	Trace	.008
Wing Hong, No. 1	99.343	.031	.040	.434	.007	.052	.010	Trace	.011	.072
Wing Hong, No. 2	98.662	.039	.035	1.035	.012	.034	.014	Trace	.011	.058
Wing Hong, No. 3	95.280	.381	.050	3.995	.020	.106	.026	.018	.008	.116
*The directors of the Company issue the following analyses.	99.847	.015	.015	.042	.001	.017	.063	—	—	—
	99.90	—	—	.05	.01	.006	.01	.008	.005	.04
	99.88	—	.022	.025	—	.027	.038	—	.004	.004

industry, and the results obtained by its employment in these important branches of constructional work have fully justified its use. If to the antifriction whitemetals we add printers' type-metal, the latter alloys being akin to some varieties of the former, a good 15 per cent. of the world's consumption of tin has to be allocated to the manufacture of these two important whitemetals.

Tin is a constituent of all true bronzes, which are essentially alloys of copper and tin. Hence all the bronzes, excluding those such as aluminium bronze and manganese bronze (unless containing tin), but including all the varieties of the alloys of the phosphor-bronze, bell metal, speculum metal whitemetal, the manufacture of which creates a demand for tin which cannot be ignored, namely, the pewters which are to-day not perhaps in great demand, and the alloys of the Britannia metal class, which latter forms the structural metal of so much of the popular variety of electro-plated goods. Britannia metal and the various other alloys from which are made the goods to be subsequently marketed as electro-plate vary very much in composition, but almost all have an appreciable tin content, and not less than 2½ per cent. of the world's supply of tin is absorbed in making up alloys of this category.

Other uses of tin are for cable sheathing, composition piping, wire tinning, die castings, fusible

Fig. 3.—A—Hearths. B—Dipping Pots. C—Wood. D—Cakes. E—Ladle. F—Copper Plate. G—Lattice-shaped Bars. H—Iron Dies. I—Wooden Mallet. K—Mass of Tin Bars. L—Shovel.

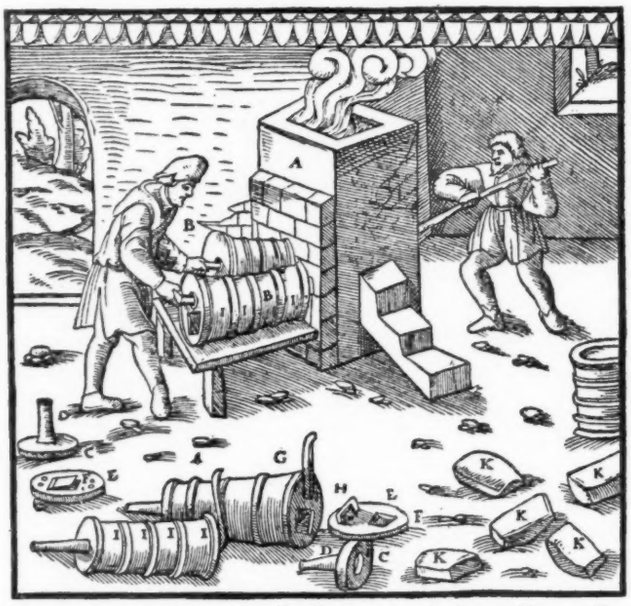


Fig. 4.—A—Furnace. B—Bellows. C—Iron Disc. D—Nozzle. E—Wooden Disc. F—Blow-hole. G—Handle. H—Haft. I—Hoops. K—Masses of Tin.

and gunmetal type, it will be found that 7½ per cent. of the world's total consumption of tin must be credited to the making of brass-founders' alloys.

What may prove to be a surprising statement in regard to the consumption of tin is the fact that over 5 per cent. of the world's consumption of this metal goes to the making of tin-foil. As in the case of tin-plate and the immunity from any metallic poisoning effects on food-stuffs in contact therewith, so with tin-foil, and in addition to this most desirable fact, tin-foil is waterproof, non-hygroscopic, and very malleable, hence the great favour in which tin-foil is held as a wrapping for food-stuffs, tobacco and many commodities which it is desirable to preserve from moisture and contamination. The manufacture of tin-foil throughout the world gives employment to many thousands of people. The head of a Chinese firm estimates that in one province alone there are more than 100,000 adults and children making tin-foil. The chief use is said to be for sacrificial purposes. Very crude methods of manufacture prevail; small ingots are beaten out in successive stages until the desired thinness is obtained, the resulting foil being usually made up into book form and marketed.

Following next in order to tin-foil in this analysis of the world's tin consumption comes the collopsible tube industry. Approximately 3 per cent. of the whole of the tin produced is swallowed up by this comparatively little-known industry. Specially-designed machinery is employed in manufacturing these tubes, and much cunning ingenuity has been shown in designing ways and means of effecting economy in this comparatively modern industry.

In addition to the antifriction whitemetals, the type-metal alloys, and the copper-tin bronzes already mentioned, there are yet other types of metals, toys, dental alloys, metal spraying, metallic paint, etc. Including the whole of the purposes named in the foregoing sentence under the heading of miscellaneous uses for which a percentage figure has not already been given, it will be found in adding up the figures already stated, that 7 per cent. only of the world's production of tin is available to cover the item "miscellaneous purposes," a none too large percentage, when one considers the very desirable properties and many applications of this useful metal.

Reclamation of Used Tin.

As previously remarked, it has been said that "Tin, once used, is practically lost for ever." In the case of many metals recovery from scrap is a fairly simple proposition. With perhaps the single exception of tin-foil, the collection of which would necessitate a well-drilled organisation, the uses to which tin is put do not readily lend themselves to the reclamation of the metal. The process involved in the recovery of tin from scrap tinning baths, tin-plate cuttings, old tinned can and domestic articles, although a somewhat costly process in itself, can be made a commercial proposition if the collection and cartage of the bulky material to be treated by the de-tinning process is properly organised. Between thirty and forty thousand tons of tin-plate cuttings are imported each year into Germany for the purpose of recovering the tin, this branch of the tin industry in Europe being almost solely in the hands of the Germans. It is estimated that in the United States 28,000 tons of metal was recovered during last year, this recovery representing about one-fourth of the total amount of tin consumed in the States during the year. Many methods have been evolved for the recovery of tin from tin-plate cuttings, etc. Among the methods proposed are included processes in which the tin is dissolved in suitable solvents and subsequently recovered by precipitation; others, in which the tin-plate scrap is heated in revolving cylinders, whereby the tin is removed in the form of grains; or

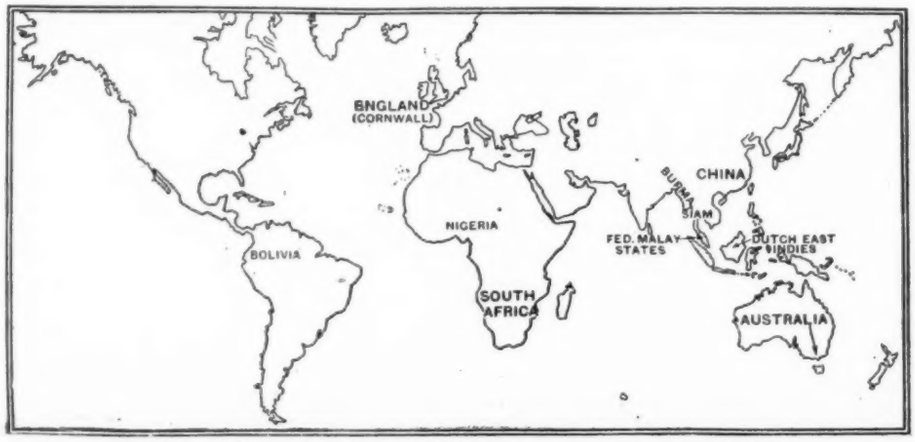


Fig. 5.—Map showing the Tin Producing Countries of the World.

heated in specially-designed chambers and the molten tin collected by draining; or heated in centrifugal machines, the molten tin being driven through sieves and collected in an outer chamber. Electrolytic tin stripping by a process the reverse to electro-plating is also employed.

Statistical.

The two following tabulated statements, the first (Table II) showing at a glance the source and the estimated supplies of the world's tin in 1926, the second (Table III) showing the world's smelter production per annum since the great war, are both interesting, enumerating as they do the countries most concerned in the production and smelting of tin.

TABLE II.—*The World's Tin*, 1926.

	Tons.
Dutch Indies	33,000
Bolivia	32,111
Federated Malay States	45,946
Malay States	2,200
Siam and Burmah	8,274
Nigeria	6,500
Australia	2,700
South Africa	1,150
Cornwall	2,000
China	6,500
Elsewhere	2,200
	142,581

Table IV sets out a statement of the world's tin consumption of recent years, from which figures it is patent that the United States "tops the bill" in respect of the consumption of tin, the tin-plate industry and automobile industry in that country being responsible for the big orders for tin. It is estimated that 25,000 to 30,000 tons of tin are used in the American tin-plate industry.

TABLE III.—*The World's Smelter Production*, 1919—1926 (*Metric Tons per annum.*) (*Metallgesellschaft.*)

		1919.	1920.	1921.	1922.	1923.	1924.	1925.	1926.
Europe	Great Britain	22,900	21,300	13,300	20,000	29,800	34,800	42,000	
	Germany	2,500	3,000	4,000	5,500	3,800	4,500	1,000	
Asia	Straits Settlement	51,900	46,200	37,700	42,100	74,000	86,000	90,700	
	Banka	12,200	14,200	25,800	27,000				
	Billiton	9,000	9,000						
	China	8,900	10,700	11,300	14,000	8,900	7,100	8,500	
America	United States	11,400	13,200	10,500	10,000	6,800			
	Bolivia	500	—	100	200	—	—	100	
Australasia—Australia		4,200	4,200	3,000	2,500	2,900	2,500	2,800	
World total		123,500	121,800	105,700	121,300	126,200	134,900	145,100	

The subjoined cash prices for standard tin each year since the Great War, together with the extreme prices in any one year, are included in order that the reader may realise the serious fluctuations in the monetary value of tin from time to time.

TABLE IV.—*World's Tin Consumption* (*Metric Tons.*)*

	1923.	1924.	1925.	1926.
United Kingdom	16,900	21,000	25,300	—
United States	77,600	64,300	77,200	—
Germany	6,500	8,400	11,100	—
France	9,200	11,000	11,100	—
Italy	2,900	3,900	4,300	—
Asia	9,000	10,000	8,000	—
Australia	1,000	1,000	1,000	—
	136,500	135,900	151,900	—

* Metallgesellschaft.

Table VII shows the imports into the United Kingdom of Nigerian ore (73 per cent. fine tin).

TABLE V.—*Cash Prices* (*London*) *for Standard Tin, each year since the Great War.*

	Average prices.	Extreme prices.
	£ s. d.	£ £
1919	257 9 8	204 and 342½
1920	296 1 7	195 ,, 419½
1921	165 8 2	148 ,, 210½
1922	159 10 9	139 ,, 187⅞
1923	202 5 0	176 ,, 240
1924	248 17 4	200¾ ,, 298¼
1925	261 1 8	229 ,, 290
1926	291 3 0	261⅜ ,, 321⅛
50 years ago (1876)	75 10 0	70 ,, 81

TABLE VI.—*U.K. Exports of English and Foreign Tin.*

	English tin.	Foreign tin.
	Tons.	Tons.
1920	13,335	13,612
1921	9,900	14,958
1922	12,579	15,463
1923	19,961	8,796
1924	18,112	10,967
1925	25,730	9,547
1926	27,419	8,828

These figures probably represent 85 per cent. of the total output of the Nigerian tin workings:—

TABLE VII.—*Nigerian Ore Imports* (*73 per cent. Fine Tin*).—("Mining Magazine").

	Tons.
1919	6,685
1920	6,022
1921	5,618
1922	6,075
1923	7,222
1924	7,550
1925	7,628
1926 (Estimated)	10,000

Of the weekly London stocks of tin in 1926, the heaviest stock in hand was about the middle of January, when the stocks reached a total of 1,500 tons. The stocks held in the third week of July totalled 213 tons. In Liverpool the highest total was 1,586 tons on June 5, and the lowest 404 tons on February 20. Swansea stocks were maintained at about 10 tons.

Tin in the Future.

Is it possible to visualise the position of tin, say, ten or fifteen years hence? Certain sources of supply, particularly those referred to as alluvial ores, are petering out, and the ore in prospect in some districts is estimated, at the present rate of production, to be likely to become exhausted within the next decade. True, other fields are opening out and prospecting is being conducted with a view of discovering fresh deposits of ore, but such known fields as are yet undeveloped are a more or less unknown quantity, and the capital required fully to exploit these fields must necessarily remain locked up for a considerable time. That further large sums of money need to be expended in winning tin, even if the present-day demands are to be continuous is beyond question.

Suggestions have been made from time to time to attempt some measure of preservation of tin by maintaining stocks of ore at the mines. Whether such a scheme is practicable is open to doubt unless an agreement can be come to among all the producing interests, and even then human nature being what it is, one can readily conceive speedy disagreement arising should a big demand warrant high prices. There has also lately been much talk of an attempt on the part of producers to stabilise the price of tin, and a figure of £300 per ton has been mentioned. Whether such a happening would be in the best interests of both producer and consumer is open to argument. It is conceivable that to stabilise the price at £300 per ton a certain restriction or at least a reservation of output for a period may be desirable. There is always danger of the price being boosted up unless such stabilisation is effected in the interests of both producer and consumer, and, moreover, all sources of supply must be under control.

To revert to the question, "What is the future of Tin?" No satisfactory substitute for tin is yet in sight. Aluminium foil may, as in America, replace tin foil to a certain extent. Chrome-plated steel sheet may to a limited extent replace tin plate, but tin finds such favour on account of the facility with which it can be industrially applied that it is extremely doubtful whether the metal is likely to be replaced by any of the substitutes at present known to metallurgists. It, therefore, behoves all those interested in the metal to pool their resources. The services of the most experienced tin prospectors, coupled with geophysical methods of prospecting on the most modern scientific lines must be employed. The most modern methods of production as called for by the local conditions must be introduced. Efficient plant must be installed, and the most desirable transport facilities must be arranged for.

Just as the foregoing relates more particularly to the mining side, so must attention be given to the smelting and refining furnaces. Co-operative smelting may be advisable in order that the most up-to-date plant can be worked at its maximum economical production. Tin reclamation must be more seriously studied, and all wasteful extravagance in the use of the metal must be discouraged throughout the tin-using industries. Only by such means as those outlined above can the increased demand for tin be met, a demand which all who have studied the question consider as inevitable.

There is surely no reason to suppose that the whole of the tin mines and tin-bearing fields are already known. Vast tracts of country in several continents are as yet unexplored and no systematic survey work or mineral prospecting has been done. The Cornish mines are likely to be good for many years to come; a great deal of renewed survey work in that country might be undertaken with advantage. In the writer's opinion there is no need to be unduly pessimistic with regard to the future of tin, but it is essential that those responsible for the world's production at the present time should concentrate in an endeavour to remove any uncertainty as to future supplies of the metal, and to establish that confidence in the mind of the user without which the best business relations between producer and consumer cannot exist. Our universities and the associated colleges number among their students many young men who are especially keen in their studies of surveying, geology, mineralogy and metallurgy. These students must receive encouragement from the principals of both mining and smelting concerns, and remunerative situations should be found for them on leaving college in order to attract the best class of worker.

As far as present-day information is available, the countries from which one may confidently expect an increased production are Bolivia, Australia, Africa, Nigeria, Tanganyika and Uganda, Lower Burma and Siam.

To the United States, which purchases a greater weight of tin than any other country, and in which country itself there is no native source of supply, one must look for the introduction of tin substitutes. As previously mentioned, aluminium foil has largely replaced tin foil in America, and one hears of vitreous non-poisonous enamelled containers replacing tin plates in certain sections of the canning industry.

Dr. C. L. Mantell, of the Pratt Institute, Brooklyn, who has recently pointed out the position of the United States in regard to tin from the economic rather than the political aspect, indicates that the task to-day from the economic standpoint is to safeguard a reasonably constant supply of tin and thereby to maintain an average price within such limits as to prevent unrest in the tin markets.

The future of tin and the tin industry depends upon the fulfilment of the task that Dr. Mantell has stated, an absence of politics and the hearty co-operation of all concerned, whether capitalist, company officer, miner, engineer, metallurgist, merchant, buyer or user.

The writer desires to make acknowledgments to the proprietors of "Quin's Metal Handbook" and "The Mining Magazine" for the statistical information and analyses; "Eastern Tin Companies Position" for the map, and "De Re Metallica," Georgius Agricola, for the plates.

American Foundry Practice.

By Anglo-American.

Moulding methods in America are very different from British, and this difference is constituted of many items, such as the extended use of wooden moulding boxes; the large number of snap-flask boxes; the varying qualities of moulding sand; the different bonds used in the sand; and many small items which tend to create speed. The author never thought there could be such a difference in the method of moulding, and the change in practice encountered going around from one shop to another in Britain is but small compared with the difference noted in the American methods.

Wooden Moulding Boxes.

It can be definitely stated that it is possible to make a casting much quicker in a wooden box than an iron box, that is to say, a casting weighing less than 10 cwt., and the uninitiated

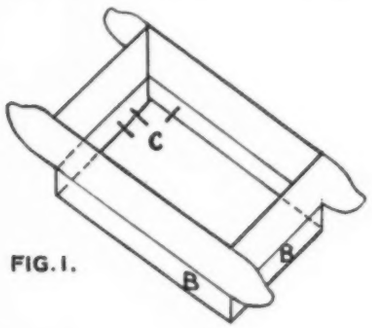


FIG. 1.

would be surprised at their life. When a job is cast in them, if there is any sign of the box burning, owing to the vents being lighted, then water is thrown on. The water is so quickly evaporated that it tends to give the boxes a longer life. Any handyman can soon get competent at making a cope, say a yard square, in about half an hour, utilising a circular saw.

Much jointing is saved by using wooden boxes, as, for instance, when there is a few lugs on the top part of the pattern. Then all the moulder has to do is get an axe and chop the bar of the cope to suit; or, again, where one has to joint down all round the pattern, then a frame is made as at B in Fig. 1, and nail it to the joint of the box. There is not much time saved if there is only one to make, but if there are several then there is a great saving; but if there are many off this particular job, and there is 3 ins. of sand all the way round the pattern, then all that is

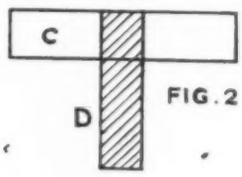
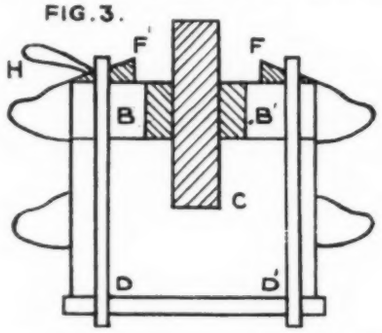


FIG. 2.

necessary would be a few nails knocked into the frame, as at C in Fig. 1, thus saving time by eliminating the necessity for gaggers, as the nails are permanent. If the pattern were so shaped that one had to make a deep joint in a certain place, then to save the quantity of gaggers and the time for putting them in, one would have a cross-bar or two nailed to the bar of the cope as deep as the lift in the mould. Again, it might be that the joint is so shaped that it is more economical to nail it to the bar C of the cope, as at D in Fig. 2. Then again if there is a core to be held down, it is very easy to knock a nail in the bar of the cope projecting out to the required thickness of the casting. As a rule, to all boxes there are only small cast-iron fins attached, about 2 ins. long, so that when the lift in the cope is deep a slide (or batten) is nailed on the box, as shown in Fig. 3. Two pieces are nailed to the cope as at B B^1, and a long one nailed to the drag, as at C. Nearly all moulds are turned over, and there are never any bars in the drag, thus one is able to ram up the drag much quicker, and a board is invariably clamped on the bottom of the drag for turn-over purposes. Very few weights are used for holding down a cope, this being done by cast-iron clamps and wooden wedges, and the clamps D, D^1 (Fig. 3) are prised on the wedge F F^1 by a chisel-pointed bar as at H. As a rule as soon as the casting will allow, the cope is taken off.

The properties of the sand in this part of America are very suitable for giving speed to moulding, whilst the sand used for light castings is of an irregular grain. Thus it possesses good adhesive qualities, and is very open—a great asset to a moulder, for he is not afraid of working his sand wet. Moreover, when finishing a mould there is plenty of Glutrin water used, and the sand will absorb it with little fear of the mould or castings blowing. The author has used sand in Britain of similar properties to this, and to increase output this type is a great help. It is one of the main factors of speed in America, as a moulder does not require to be so careful when using it and still achieves good results. For small work, when dusting on to a pattern, Partomol, a proprietary material, makes a good parting, and is much better than river sand. It is dusted on out of a fine bag, and for any joint where the moulder

FIG. 3.



would have to wet river sand to stick, Partomol can be used dry with confidence. It is extensively used for bench moulding, but only occasionally for floor moulding. Oil sand is used to a great extent by the coremakers, but very few of the oil-sand cores are blacked. The principal reason why coremakers in Britain dislike oil-sand cores is because the hot-blacking of cores evolves stifling fumes. Glutrin water is used feely as a bond with the core sand, and is bought in the liquid state. Another bond used extensively is molasses or treacle.

The author has often heard it said that as soon as an Old-Country moulder steps into an American moulding shop the foreman usually says, "Now, partner, it is quantity here not quality," and he is left at that. It is generally correct, and unless a certain casting is of extreme importance, then the foreman will say he wants a "very clean job." Moulders in America have very little walking about to do, as they are supplied with all their chief requirements. The author has often thought of the care a British moulder takes when making his joint, not that it is his wish, as he has heard foremen grumble if a joint was not made to "look nice," but if these foremen saw how joints are made in America they would say what a slovenly way of working, for nearly all joints are made by hand. As an illustration, when moulding a wheel, to make the joint the moulder just goes round it with his hand to half the depth; brushes it out, or blows the loose sand out; puts on "Partomol," and omits any sleeking of the joint. When lifting the pattern out, if a little of the sand has been loosened on the rim or arm, the moulder is not afraid of leaving it and relying upon the cope to push it back into position, but with 90 per cent. of the sands used in Britain it would be extremely risky; but American sand is ideal for moulding purposes. Quite often the author has felt certain that moulds would crush in when clamping down or putting on the cope, but, curiously enough, it has been satisfactory. It is seldom one encounters a crush on a casting, whilst there is very little fin on the joints. Moulders never have to be so careful in ramming up as they seldom have any "swells" on a casting, not that they ram it hard all over, usually it is the reverse. The machinists are very particular as to what kind of iron they get, as the softer it is, the better they like it. Very little is turned off, for being paid piecework, if the castings are too hard, the machinists reject them or complain to the foundry. As a rule the metal is exceptionally soft and runs very well, there being but few wasters from "short runs." Quite often moulds "run out" when being cast and it takes a long time to stop it. For general engineering castings the silicon is as high as 2.7 per cent., and probably also high in phosphorus to give it this life. The people who buy the castings are not so particular as they are in Britain, and the remark is often made that "We don't want to make castings to last a lifetime, we hope to make them again in our time."

Company Meetings.

Ferranti, Limited.—The twenty-second annual meeting was held in London recently. Dr. S. Z. de Ferranti, who presided, said that the policy of the board had been to provide and maintain such manufacturing facilities as would enable the company to deal with a larger share of the ever-increasing electrical business, and at the same time to reduce manufacturing costs and selling prices, so as to ensure a more extended use of the company's product, a policy which he felt sure would make their position in the industry more secure, and give them a safe return in the future.

Samuel Osborn & Company, Limited.—"If we are to maintain and improve our trade in the future, two conditions are most necessary. They are industrial peace and substantial relief in national taxation and local rates," said Mr. W. F. Osborn, addressing a meeting of the shareholders of Samuel Osborn & Company, Limited. He said that since the company was founded in April, 1852, at Brook Hill, its record was one of continual development and expansion. During the war practically the whole of the works' production was turned over to the manufacture of war materials, and, like many other manufacturers, they were left with abnormal and unsaleable stocks when it concluded. Burys & Company, Limited, was acquired in 1915, and on February 18, 1920, the company was converted into a public company. He said that the relationships existing between the management and the men had always been of a happy and friendly nature, and, if they had had a free hand, there would have been no stoppages at the Clyde Works in the past.

United Steel Companies, Limited.—Reference to the damaging effect of Continental dumping on the British steel and allied trades was made at Sheffield on October 24 by Mr. A. O. Peech, chairman of the United Steel Companies, Limited, at the annual meeting of the shareholders. It was important, said Mr. Peech, that possibilities of improving the country's trade position should be thoroughly surveyed without further delay, as there were disturbing indications that it was being seriously prejudiced. The volume of trade being done in this country by Continental steel suppliers was greater than anything previously experienced, and there were indications that the pressure of this competition would increase. It came from countries which had adopted a course of action and a political standpoint entirely in opposition to those of this country respecting the method of fostering industry and employment. The difference in essence was that, in competing countries, a direct effort was made by the Governments concerned to stimulate adequate employment, on the assumption that regular work would enable the operative to provide for his own needs. In contrast the State in this country undertook, in the first instance, to provide for the social welfare of the worker, and thereafter hoped that the worker would be enabled to find employment. Continental nations, in providing for their industries a strongly protected home market, had enabled their steel trade to work at approximately maximum output and to reduce production costs very substantially. As a result, they had been able to sell their surplus production in this country at prices fixed without reference to economic cost.

Making Motor Cylinder Castings.

As previously briefly reported in these columns, Mr. W. West, of Leyland Motors, Limited, lectured to the members of the Lancashire Branch of the I.B.F. on October 1, upon the subject of motor cylinder castings as an illustration of the progress which has been made in the use of oil sand. A series of lantern slides and a cinematograph film exemplified the subject by showing different phases of the work carried out at the works of Messrs. Leyland Motors, Limited.

The preface of the lecture dealt specifically with the end to which the theoretical work had been performed, also the observation that such work had been prompted by a chance remark reported in the discussions connected with a lecture given at the Lancashire Branch two or three years ago.

In dealing with the subject of oil sand, the lecturer laid stress upon the importance of clearly defining that the term was used in the true sense and not including such additions as red sand or clay of any description.

The great disadvantage which had been found with a plain mixture of oil and sand was the weakness or inability to stand up when turned out of the core box in its green state. The tender nature of the mixture made it necessary for the additions of gums and farinaceous substances which provide the cohesion during the period of drying. It was in this direction that the experiments to be described were and are now being directed. To his mind, much of the valuable work already published on this subject expressed the results in terms of physical strength of the dried core; this was a point of interest which gave a comparative result between any two kinds of binders but entirely lacks any useful information to the foundrymen. The strength or weakness of a core in the dried state largely depends to what extent the binding agent had been destroyed during the baking operation—in some cases the binding medium gives a quality of hardness quite different from another—in the first instance the hardness is not so easily broken down when exposed to the liquid metal, in the other, the reverse is experienced as exemplified in a mixture containing water in contrast to a mixture when it is absent. Green bond strength, however, affects every foundryman, especially when the shape in intricate, with thin sections of overhanging parts. This particular property can only be obtained, however, by the use of ingredients which have in themselves the power to mix homogeneously and give in this form the strength required. Experiments had shown that such a mixture was possible and not only so, but that the chemical properties were of a nature to quickly dry on the surface within a minute or two of turning out of the box, which proved of immense assistance.

Vote of Thanks.

MR. W. H. SHERBURN, in proposing a vote of thanks to Mr. West and his firm, Messrs. Leyland Motors, Limited, said one thing which struck him forcibly was the statement that the work which Mr. West had been carrying out with regard to oil sand was prompted by a remark made by one of their branch members. The problem had been tackled in a unique way and the verbal description had been supplemented in a very interesting way by the cinematograph film, making the subject quite clear.

MR. MASTERS seconded the vote of thanks, which was carried unanimously.

In replying, MR. WEST stated that the little progress which had been made was only accomplished by a combination of the theoretical with the practical, and the technicalities introduced into the lecture were so expressed as to make the sequence of results clearly defined and also to give assurance and inspire confidence that any decisions arrived at were based on a sound foundation.

Discussion.

In the discussion which followed MR. SHERBURN enquired what was the mixture of ingredients constituting the moulds shown on the lecture table, and in what type of oven they were baked.

One Mixture Insufficient for Automobile Castings.

Mr. West said that some four or five kinds of mixtures were used by them, each of which was suitable for a different type of work. He was willing to give particulars of them if supplied with the exact conditions under which it was proposed to use them. What had been entirely successful in their own foundries had been found a failure in others until the correct treatment and mixing of the oil ingredients with the sand were learned.

The drying ovens were fed with coke fuel, having the conduction of the heat into the ovens so arranged that it came upon one side and after circulating across the width passed out through small flues in the other side. This arrangement was arrived at as a result of their own experiments; originally the hot gases came in at one end and passed through the length of the oven and out by the flues at the opposite end. Under these conditions the cores situated near the entrance of the gases were quickly and effectively baked ready for withdrawal, while towards the opposite end there was a gradual difference in the colour of the cores until those near the exit end of the chamber were very unequally baked. As to the detail connection of the flues, one main flue came direct from the fire box and passed under the ends of the ovens at one side only—the side branch flues were then taken from this along one side of each oven situated directly at right-angles to the main flue. These branch flues stopped short of the ends of the oven and were arranged with openings at three regular intervals into the drying chamber. The heat then proceeded in the direction described across the oven, making exit through a similar branch flue connected with a flue to the chimney.

Drying Cores.

MR. S. G. SMITH said he wished to enlarge upon the question of drying. As the lecturer had clearly described to them, all good oil-sand mixtures had for their base linseed oil, and this dried by virtue of its power to absorb oxygen from the air, and so form the dried bond with which they were familiar. In this case then it was of the utmost importance to arrange that in the drying chamber a good supply of air should be present to accelerate the action of drying. Would the lecturer, therefore, describe the method he adopted for introducing this air into his furnaces. Was there a continual current of air passing through the stove?

Some of the cores, he noted, were dried in 20 minutes, others, the weight of which reached hundredweights, were dried in one hour. He thought there must be some continuous process of introducing oxygen to dry these cores in such a short time.

He had understood from Mr. West that there was not one atom of moisture in the oil mixture. He thought this was exceptional. Was there any guide to the time of drying according to the weight or thickness of the core. Another point was whether at the works of Leyland Motors, Limited there was any standardised way of testing a core for dryness. This was the most important point in the making of cores.

Furnace Details.

Mr. West explained in reply that around the fire box, but not in connection with it, was a chamber into which air was allowed to enter. It passed from that chamber into the main flue, some distance from the fire box, and acted as secondary air throughout. The supply of air was forced through into the main by means of the firing hole being under pressure. To his mind, the secret of quick and successful drying of cores was to have the mixture so constituted that it was immediately in a condition to react with the oxygen in the oven; this was not so where moisture or water was present, because of the fact that the water had to be driven from the mixture before the oil, etc., was capable of absorbing oxygen. This fact should be borne in mind when purchases of core mixture were made—if production was of vital importance then the various crèmes on the market when used were not calculated to give the minimum of drying time, as a water content of any figure up to 40 per cent. was contained in them.

The time of drying was also dependent upon the size and weight of the core—the small piston cores were effectively dried in 20 minutes, but at exactly the same temperature as the larger cores—it was at this temperature of 250 deg. C. minimum that the changes in the physical and chemical character of the oil took place, which made all the difference. Temperature regulation is carried out by means of pyrometers, but it has been found in practice that the men on the charging stoves have become so accustomed to the handling of them, and the consistency of the oil sand so constant, that the regulation is really carried out by time and the colour of the cores. The pyrometers used are of the recording type, which provides a useful means of checking the operations.

Referring to the use of mixtures containing water, and the practice of some firms in not drying their sand before mixing, Mr. West gave his opinion that this particular point was one that no definition could be laid down, but much depended upon the character of the cores to be made.

Introduction of Drying Air into Core Stoves.

MR. MASTERS said he did not agree with the idea that sand should be used wet or dry according to the class of work. His view was that for the best conditions it was essential to use dry sand. Perhaps it was not so economical, because many people had not facilities for getting dry sand, but where those facilities were enjoyed dry sand gave better results in all classes of work whatever compounds were used in the particular mixture, whether it was by the emulsion of water with linseed oil or other materials. There were mixtures on the market which had no water in them, and he had himself seen cores weighing five tons made with such compound. Some firms were going in extensively for oil sand work, and were using definitely dry sand for every core made.

He had heard that at Leyland Motors, Limited, facilities were such for getting new sand that they dumped the old sand and did not take any steps to reclaim part of it. Everybody was not so well placed. It was possible to use 40 to 50 per cent. of reclaimed sand, that is sand which came back from the dressing shop, was put through a screen, and then used again in the mixture. He believed quite good results were obtained. What method did Mr. West adopt for mixing the sand and the binder together? Was it a rubbing or milling action?

Influence of Water.

MR. WEST, in reply, said that dry sand was used throughout the whole of their operations. They mixed about 100 tons per week without a thimbleful of water being present. However, this was entirely from the point of view of production; if a foundryman adopted the use of a crème, then the effect of using dry sand was entirely lost on account of the fact that he could introduce water by way of the crème core oil additions.

It was useless to suppose under these circumstances that better regulation could be obtained, because the foundryman is generally totally unaware of the amount of water in the crème emulsion sold to him. He had quite an open mind on the matter, and had seen large cores made without first drying the sand, but time of drying of the cores was of no consequence—the question was one of local conditions, the nature of the work and the disposition of the people using the material.

They at Leyland Motors made their mixtures themselves, and did not use proprietary brands. He knew some of these latter compounds, which were very good, the only objection he had to them was cost.

As mentioned, they obtained their sand at a low rate of 6s. per ton into the works, which made the use of old sand unnecessary. Forty to 50 per cent. of burnt sand could be used in the mixtures quite effectively, but it was not to be imagined that any benefit could be obtained

from the bonding material originally contained in the mixture, as this had been destroyed or rendered ineffective by the subsequent treatment, either drying or during the casting of the metal.

The question raised concerning the action desired during the mixing of the sand mixture was an interesting one. They were at Leyland at present engaged in some experimental work to determine exactly what happened during simple mixing in a paddle mixer, in a mill with light rollers, and in a mill with heavy rollers. There was no question as to which method produced the highest degree of green bond strength—as all their core makers engaged on the making of intricate jacket cores insisted that the sand through the mill with heavy rollers was far ahead of the other sands.

One would naturally expect that the sand which passed under the heavy rollers would have some of the grains broken up, but the point is, to what extent does this action really proceed. In the case of dry sand without any of the slippery ingredients, the action takes place to a large extent, but in the presence of gum, rosin, and other such binders it is noticeable that when the mixture comes to the state of plasticity there is a sliding action as the mixture passes under the millers, and where these are adjustable the maximum effect in terms of green bond strength can be obtained with very little breaking of the sand grains.

Spent Sand and Core Gum Binders.

Mr. Sutcliffe asked whether Mr. West had tried core gum only for his cores. Spent sand with a certain amount of gum was much cheaper than the other mixtures.

Mr. West replied that the cost of their mixtures averaged 7½d. per cwt. of mixed sand ready for the core makers. Owing to the close vicinity of their iron and steel foundries both drew their supplies of oil sand from one sand mixing plant, and for sake of convenience those mixtures which met the requirements of the steel foundry were also used in the iron foundry, though he had no doubt a greater proportion of sand could be added for the needs of the latter.

His experience was that core gum or dextrine did not give the necessary green bond strength, and needed addition of other ingredients to supply the deficiency.

Core Making Cheaper than Moulding?

Mr. E. W. Longden said he could understand the utility of making the cylinder and cylinder head in oil sand cores, but he could not at all understand the economics of the moulding practice for making such small castings as the covers in cores. Foundrymen who were accustomed to repetition castings would know that such castings could be very rapidly made by plate or machine moulding. To his mind the core method for small castings outlined by Mr. West could not be thought of in comparison. He was, on the other hand, very pleased to have listened to the finest lecture on oil sand cores that he had ever heard or read about.

He considered that $\frac{1}{16}$ inch for machining was not sufficient to allow the machinist to machine readily by allowing the tool a deeper cut to get under the hard skin of the casting.

It was rather startling to hear Mr. West say that they dépended upon the coremaker to determine the drying temperature. Mr. West had stated that the drying temperature was 250 deg. C., and that if the temperature rose to 280 deg. C. the cores would fall to pieces. Could he be sure that the persons firing could, by guess, determine that the products of combustion will pass to the stoves at the right temperature? The range was only about 30 deg. C.

Mr. West, in his answer, gave the information to the effect that $\frac{1}{16}$ allowance was sufficient for grinding, but not for machining. The flour and water paste mixture used for pasting the core together had not the slightest effect upon dimensions of the cylinder casting, due to the fact that in the process of drying a greater portion of the paste was absorbed by the large surface area of the oil sand mould to which it was exposed, the weight of the top half of the mould being sufficient to ensure the pressure necessary to distribute the paste.

The Estimation of Copper in Aluminium Alloys.

By H. H. Shepherd.

Solutions Required.

Standard Solution of Sodium Thio-sulphate is made by dissolving 25 grammes of the pure salt in a quantity of cold distilled water contained in a calibrated litre flask, and then diluting the solution to the mark. The copper equivalent of the solution is determined by standardising against a standard solution of copper nitrate.

Standard Solution of Copper Nitrate.—This is prepared by cleaning a quantity of pure copper foil (99.95 per cent.), and immersing it for a few seconds in dilute H_2SO_4, and then washing well with hot water. Weigh out exactly 3 grs., transfer to a 200-c.c. beaker, cover with about 20 c.c. of water, and add 20 c.c. of concentrated HNO_3; boil the solution free from nitrogen oxide fumes, taking care not to get any of the solution on to the sides of the beaker, above the liquid level; the boiling is best brought about by heating over a wire gauze. Cool the solution to normal temperature, and transfer to a 250-c.c. calibrated flask, and dilute with water up to the 250-c.c. mark; 25 c.c. of this solution contains very nearly 0.30 grs. of copper, or, to be exact, 0.2998 grs., seeing that the copper is 99.95 per cent. pure.

Sodium Carbonate (50 per cent. Solution).—Dissolve 120 grs. of the anhydrous Na_2CO_3 in 400 c.c. of hot water. If necessary, filter whilst hot through a qualitative paper.

Acetic Acid.—This is a 25 per cent. solution of glacial acetic acid in water.

Potassium Iodide.—This is a 20 per cent. solution in water. Keep in a well-stoppered bottle.

Starch Solution (1.0 per cent.).—To make this use soluble starch. No more than a week's supply should be made at a time. The solution is best prepared by mixing the starch into a thin paste with cold water, then pouring on to this the required amount of boiling water; to ensure a practically clear solution, free from floculent or gelatinous matter, the cold paste should be well shaken immediately before adding the boiling water. When mixed, it should be poured back into the beaker it was made in and boiled for one to two minutes, then cooled and transferred to a bottle having a well-fitting stopper. The little extra trouble which is incurred by making the starch in this manner instead of the usual haphazard manner is well compensated for by the sharp end-reaction the starch gives and the length of time it remains in good condition.

Standardisation of the Sodium Thiosulphate.

Transfer exactly 25 c.c. of the standard copper nitrate solution into a 250-c.c. conical flask. This is best measured by a 25-c.c. pipette, and the pipette should have previously been tested against the burette which is to be used for the thio-sulphate, when measured at different points in the burette.

Add to the 25 c.c. of copper solution just sufficient sodium carbonate solution to create a slight precipitate. Some chemists recommend the use of ammonium hydrate in place of sodium carbonate for neutralising the solution or to bring about the slight precipitation of copper salt, but the writer has repeatedly observed that the use of NH_4OH is not nearly so efficient as the Na_2CO_3, as control of the neutralisation is not so good and the end-point of the titration of the copper with the thio-sulphate is not so definite; while in several instances it has appeared that ammonium salts affect the accuracy of the results, so the writer abandoned the use of the ammonium solution in favour of a strong solution of sodium carbonate, and found that it leads to much more consistent and accurate results, and also to increased confidence on the part of the junior chemist.

It was stated above that just enough Na_2CO_3 should be added to create a just permanent precipitate; this step in the analysis is often regarded as a minor detail, but if reliable results are to be produced it must be treated as a very important point. The carbonate solution should be added a few drops at a time, a burette being useful to make these additions. At the first sign of a precipitate, stop adding the solution and shake the flask; if the precipitate remains undissolved then the correct point has been reached.

The importance of being very careful at this stage will be appreciated when one realises the effect it has upon the result. It has been shown by several authorities that an excess of sodium carbonate—which since it is converted into sodium acetate later by the addition of acetic acid, may be regarded as excess sodium acetate—seriously interferes with the accuracy of the results, chiefly because it renders the production of a clear and permanent end-point. A solution which has been correctly neutralised and acidified will possess a clean cream coloration, which is permanent after titration is finished. A solution containing excess sodium acetate will not yield a definite and clean end-point; it may yield an apparent one, only to change—almost immediately if the excess is large—to first a dirty cream-grey, and finally becomes blue again before the titration is finished, and so creating uncertainty in the operator's mind and lack of confidence in his results. There is only one thing to do when this uncertainty arises—that is, to scrap the determination and make a fresh start, taking care to watch carefully the neutralisation and acidification. Having obtained a permanent precipitate in the copper solution, add dilute acetic acid, a few drops at a time, until the precipitate is just dissolved; then add not more than 1 c.c. in excess. Add 15 c.c. of potassium iodide solution and shake well. From the burette containing the thio-sulphate, run this solution into the copper solution. The latter solution must be at normal temperature. Shake the solution during the additions from the burette; these additions should be continued until the copper solution becomes straw coloured, then add from a pipette 5 c.c. of the 1 per cent. starch solution. Now carefully continue the additions of thio-sulphate until the copper solution shows signs of changing to cream colour, then carefully finish off the titration to the nearest tenth of a c.c. The end of the titration is shown clearly by the copper solution suddenly assuming a cream colour which is permanent for at least three minutes. The end-point is very sharp if the proper conditions and precautions have been observed, and with a good burette having a fine orifice at the delivery end it is quite easy to read the titration accurately to 0.05 c.c. The readings should be as accurate as possible, as a slight error in this direction causes an appreciable difference in the copper factor obtained for the thio-sulphate solution.

Excessive dilution of the copper solution also tends to mask the end-point by rendering it indistinct, and often causing a return of the blue colour shortly after the titration is deemed to be finished; hence, prior to commencement of titration, the copper solution should be kept low in volume, preferably below 50 c.c.

Determining the Copper Content of the Sample.

Transfer a portion of the filtrate from the tin, estimation, say, 100 c.c. (equal to 1.50-gr. sample), to a 250-c.c. conical flask, evaporate to 15 to 20 c.c., cool well, then proceed exactly as described for the standardisation of the sodium thio-sulphate solution by the standard copper solution, the only difference being in the amount of potassium iodide required, which varies according to the alloy under examination; if it is known to be a L 5 sample, then 5 c.c. will be ample; if a L 11, then use 10 c.c.; for L 8 or unknown samples use 15 or 20 c.c. Further, *in the case of low copper alloys as L 5 the starch is best added before making any thio-sulphate additions—that is, before titrating*, as there is a danger of overshooting the end-point.

Vickers, Limited, and Sir W. G. Armstrong, Whitworth & Company, Limited, have reached a provisional agreement for the amalgamation of certain of their important works and businesses now engaged principally in naval shipbuilding and in the manufacture of heavy and special steel, and armaments. The agreement provides for the formation of a new company to take over the amalgamated businesses from January 1, 1928. The whole matter will be submitted at an early date for the approval of the debenture holders and shareholders of both companies.

National Wealth—How Produced and How We Share in It.*

By Victor Stobie.

Although an understanding of this topic will not help us to make better castings, it will probably make clear why we are not getting more orders for them.

The subject is simple if we do not allow it to be surrounded with mysticism and abstruseness, and it is of intense importance to us. The chaotic condition into which the industries of this country have drifted for so long a time, and seem to have taken permanent abode, is the clearest sign that we are face to face with ugly facts in relation to our national position. National wealth is not an entity in itself. It represents the potential value of the total of private and communal wealth of the citizens of a nation.

Let us review the simple meaning and substance of "Wealth."

The output of a certain man's labour is worth, say, £5 per week. To feed, clothe, house and entertain him costs, assume, £4 per week. The balance of his production of work over his consumption of work for the week is, therefore, £1. He may put that excess £1 in the bank or in an industrial business or in the building of a house; but, wherever he puts it, he has stored up £1 worth of his own excess labour with which, at any desired moment, he can buy £1 worth of labour from someone else. That excess £1 worth of stored up labour is "Wealth."

The vast majority of wealth is not in the form of money. Its money value has, usually, been used (exchanged) to bring into existence divers kinds of property. By "property" is here meant anything useful which can be possessed by a person. Money, property, and stored up labour, are, therefore, under normal circumstances, economic equivalents: the one can be exchanged for the other.

The foregoing also tells us that the man who consumes as much work as he produces cannot create wealth; and is of no *economic* value to the community. Such a man makes no economic difference whether dead or alive, because, when dead, he consumes nothing; and, when alive, he eats a crumb for every crumb he produces.

Destruction of Wealth.

Having realised how wealth comes into existence, let us examine how it can be destroyed.

The wealth represented by property (I should say at least 90 per cent. of the total) maintains its value only so long as the utility of the property itself is maintained.

Much of this country's wealth accumulated in the past has been invested in industrial works; a vast number of which are either closed down or losing money. The wealth previously represented by those works has disappeared because its present form serves no economically useful purpose.

Wealth is also destroyed when it is used to provide unnecessary commodities. It is agreed a certain amount of "unnecessary commodities" are advisable for the embellishment of this work-a-day world; but this address is concerned only with general principles.

Can our national wealth, our stored up labour, be increased under the present conditions in this country? One is forced to answer negatively. Without that stored up labour, however, there is no possible chance of a return to the prosperity this country knew before the war.

What is necessary to effect a change? There are several factors, each of which, alone, can have a mighty effect; but, for a full return to prosperity, we require most of them together. Some are:—

1.—*A much lower consumption per man.*

When I speak of consumption here, I refer to consumption of, or expenditure on, completely vanishing commodities. For instance, all expenditure in rates, taxes and such matters comes under this heading and is lost to the national wealth; except in so far as it is used for the creation or maintenance of useful property, roads or for necessary public services.

2.—*A much higher production per man.*

By production, I mean materially useful production. All production of arms, amusements, luxuries, social benefits and the like, although much of it advisable, is, nevertheless, not production within the field of our present subject. Such work cannot possibly produce wealth. It can, at most, only transfer the ownership of some of the wealth expended upon it; with total loss of the remainder.

3.—*The monetary value of profit and of labour to be measurably similar to those of other nations.*

For example, assume a piece of machinery to cost here £100. In another country, where labour, profit and living cost, relatively, a quarter less per unit than here, the same machine would cost, approximately, £75. We have no chance of selling our £100 machine under such conditions. If labour and all its products cost one-quarter less in the foreign country, the worker in that country can buy exactly as much with his lower wages or profit as our worker can with his, apparently, higher wages or profit. Thus the foreign worker gets the orders, and at what is to him exactly the equivalent of our price!

What would it matter whether we received sixpence or six shillings per hour for our labour or as a manufacturing profit if, in the former case, everything we bought with our wages, or our profit, cost only one penny for every shilling it cost in the latter case? Everything we require in life, other than the air we breathe, needs labour and capital (still another equivalent word for stored up labour) to produce it or to fit it for consumption. It follows, therefore, that the lower the recognised monetary equivalent of a unit of labour and of profit, the lower, in proportion, will be the cost of living.

A determined intention to pursue No. 2 above, *i.e.*, a higher production per man for a given unit of wage or profit, is, perhaps, a sufficient and, on the whole, the most easy life line for us to grasp. Take, for instance, the known result in the U.S.A. They are gathering in the world's riches by out and out exercise of a mighty output per man. There is no other reason why such vast numbers of their skilled artisans own motor cars and other luxuries which our workpeople cannot buy.

We have often led the world in clever conception; let us be sufficiently sound at heart to follow others' lead, when advantageous, and to drop the dog-in-the-manger attitude of wanting fictitious wages and profits for low output and service.

The old scarecrow with which many tried to choke off the use of machinery in the last century, on the score that the displacing of hand work by machinery would lead to wholesale unemployment, is dressed up in the same old costume to-day, dyed another colour. The old bogey would now have us believe that a greater output per man would also lead to fewer men being employed.

The inevitable result of a greater output per man for a given profit or wage would be exactly the same as resulted from the use of quick machinery to replace hand work. Can it be otherwise? It would bring down the price of the article produced and permit of a greater consumption for a given sum of money. If I am a bootmaker and I turn out two pairs of boots in the time I previously took to make one pair, I can sell them both at half price to my neighbour, who could previously only afford one pair. If my neighbour is a tailor and he produces twice his previous output of clothes in a given time for a given remuneration, I can afford to buy two suits from him for every one I previously bought, *even though I have sold my boots at only half their previous price.* This is the only way that the standard of living can be improved. It permits a given wage or profit to buy more of the amenities of life because more are *produced* for the money.

If, on the other hand, I only turn out one pair of boots in the same time and ask for twice the price, believing thus to improve my standard of living, I shall find that everyone else, if they are to buy my boots, must ask for twice the price for an equal amount of their labour in order to be able to pay my price for the boots. The result will be that everyone will get the same total amount as before in weekly wages or profit for half the output of labour; everything will, therefore, cost twice as much; and there will be, automatically, a low standard of living.

Unfortunately, little change can be made for himself by an individual if he, alone, turns out a greater production for a given remuneration. It must be done by a very large group of workers. By "worker" I mean, throughout this address, anyone engaged in the manufacturing and selling of a commodity. If, for instance, all the employers' associations in an industry met together to decide upon a reasonably higher output for little or no extra wages and profits, their industry would benefit as it would get all the available orders, both at home and abroad, and would create increased demand due to the lessened price of the commodity. If the main British industrial associations took such a bull by the horns, it would require little, if anything, else to bring back prosperity to their industries and to the whole country.

* Delivered as a Presidential Address before the Newcastle Section of the Institute of British Foundrymen.

A Chrome Plating Development.

Dr. W. Pfanhauser, of the Langbein Pfanhauser Works, Leipzig, writing in the "Brass World," states that Dr. Von Bosse has been successful in discovering a process which enables the complete removal of the hydrogen generated during the chrome plating process from the chrome deposit, before the occurrence of cracks, and without involving any appreciable increase in the temperature of the plated articles. Attempts have been made to remove the hydrogen by means of a thermic treatment of the chrome plated articles, either by heating in stoves or by dipping in molten metallic salts, such as molten lead, and the like. The invariable result of such a sudden increase of temperature is that the layer of chromium splits, and then corrosion sets in.

Under the new process of Dr. Von Bosse the treatment is quite opposite—it is a cold treatment in a vacuum apparatus of the chrome plated articles to be freed of gas, on the principle of the diffusion of electrodes. For this purpose the articles to be treated (it is immaterial of what metal they are made) are secured to a suitable holder contrivance on the electrode rods, which are in the interior of the vacuum apparatus, in a similar manner to that which is customary in electroplating.

After the air in the vacuum vessel has been pumped out by a rapidly operating air pump until a high vacuum has been produced, a high pressure alternating current is connected to the electrodes whereby rays of light are emanated from the articles. The light rays convey with them the hydrogen contents, which are at once removed by the vacuum pump. In such a combination of chromium and hydrogen the hydrogen functions as a noble metal, and therefore is subject to the same conditions as, say, gold or silver. The evacuation, even of large vessels, can be effected in a few minutes, and requires only a small current consumption. The removal of the gas can be effected in 10 to 15 minutes in the case of a chromium layer of normal thickness.

The completion of the removal of the gas can be observed by suitable high vacuum instruments. Moreover the practised eye can observe the progress of the liberation of the gas through suitable peep-holes, as the light emitted from the articles to be gas freed alters after the gas has been completely liberated. Especially valuable is the fact that the hydrogen is not only removed from the chromium deposit, but it is also completely liberated from the base metal, as for instance, copper, brass, iron, steel, etc., which hydrogen often hardens so that edges split ofter plating.

Visualising the Future of the Foundry.

Presidential Address to East Midlands Foundrymen.

At the opening meeting of East Midland Branch of the Institute of British Foundrymen, the incoming President, Mr. H. Pemberton, delivered his Presidential address, in the course of which he said:—

Mr. Stevenson and Gentlemen,—The title of my address is "Prospective View of the Foundry," and the reason for taking such a subject is that I feel I cannot do better than draw attention to the future demands of the industry, and, in this manner, it is hoped to develop two factors—efficiency and ambition—which are vital to successful development.

Efficiency can be defined as the power to produce effect, whilst ambition is a general desire of superiority in honour, power and excellence.

To achieve these founders must avail themselves of every possible means which lends itself to these ends, and it is only by sinking their rather conservative ideas that they will be able to approach this subject in any true spirit of progress. Once they have established this attitude generally they will have gone a long way towards bringing about that co-operative spirit from which all will benefit and prosper.

Founders are reminded of future demands by the various "Trade Fairs" that take place from time to time, which indicate the gradual but sure growth of the motor industry; the railway services which are building bigger and more powerful engines to handle heavier goods and passenger traffic, which means greater demands of the tracks; the aeroplane industry, and, by no means least, the shipping industry. These are the industries which in their own development are dependent upon a corresponding development from the foundry.

To increase their trade the foundry industry must increase its production, and to do this on an imperial scale does not just mean the adaption of machines, but amalgamation, standardisation, and co-operation. Three outstanding instances may be used to emphasise this—Ford motors, Morris motors, and Qual-Cast mowers—as they stress standardisation. Where common interest exists it would be wise to consider the possibilities of amalgamation, as it immediately brings about strengthened capital, and by standardising methods a cheaper and better production would result. Another obvious advantage resulting from this scheme would be co-operation, gained by the merging of common interests.

In all large engineering works which includes a foundry, it is a common experience that apprentices, on being engaged, never ask for a job in the foundry, because this department is always associated in their mind with heat, sand, and dirt. To my mind there is no reason why the foundry business should not be conducted under conditions comparable with those prevailing in any up-to-date machine shop. The moulding machine shop of the future should be completely separated from the melting and casting department, which latter again should be similarly separated from the knocking out of castings and coremaking. Whilst these three must of necessity synchronise, they can be completely separated, and undoubtedly with these conditions the foundrymen's physical and mental conditions would respond in a manner which would more than repay the outlay that such hygienic conditions would demand.

It is not impossible that the future will see cast iron melted by means of electrical power, instead of the cupola, and additionally do this much quicker, with lower losses, under better control, and perhaps cheaper, whilst undoubtedly ensuring a better quality. Again, have we reached finality from the metal standpoint—it is possible that a metal may one day be evolved which will embrace all the features of the metals at present commonly used, cast iron, steel, and brass? Shall we always be in the dark with regard to what is happening in the mould when casting? I venture to think that an instrument is possible on the principle of the X-ray, which will enable us to see what is actually going on inside the mould during the casting operations.

Die Castings.

Immense progress has been made during recent years in developing die castings of various metals. By standardising much greater scope would be extended in this modern method. By this method thousands of tons of metal are being saved by abolishing any machine work. Articles can be accurately turned out to size, cored out with threads ready for assembling. These are but a few directions in which foundrymen can profitably concentrate their thoughts. Accuracy, with a minimum of machining work, is where the foundry will and must establish itself as a dominating factor in the engineering world. The present practice of buying costly machines for the machine shop will, it is anticipated, be displaced by installing equipment in the foundry which will be capable of producing articles, which, if not actually finished, will require but a minimum of further operations. Some of you may think that the expression of these ideas is rather advanced, but I would remind you that the Institute has become the accepted channel by which progressive ideas can be assured of thoughtful consideration.

Another matter which demands a good deal of thought and attention is the promotion of junior sections, which is a movement in the right direction, and every possible encouragement should be given to the young members to develop with a view of fitting and preparing themselves for responsible positions. Experienced men can do much to encourage the younger generation, by inviting their opinions and thus rousing the spirit of initiative.

Co-operative Effort.

In recent years there has been a marked improvement in the relations between the designers, pattern shop, and foundries. This has been brought about by the repeated appeals made through this Institute. It is this form of co-operative spirit that will assist in reducing unnecessary labour, time and money. We have reached a stage to-day when we must be prepared to sink our identity for the more important one of national prosperity, and to achieve this we must develop the team spirit, whereby collective effort can be used to our mutual benefit and not for individual glory. I further venture to suggest that with the right spirit actuating the management of any works, it will be found that the same spirit operates among the employees, and that there will exist a very real interest in the firm's business.

Commercial Side of Foundry Work.

This, no less than the practical side, must be approached in a bold manner if we are to secure that "future" position which is so essential. We all have confidence in the goods we produce, and claim for them that they are the best possible. To be pertinent—Are they? Could we do a little better? Is the price right? Could we market them a little cheaper, or could we improve them at the price? If you are satisfied that you are producing the best article at a reasonable figure then let the world know. But that will never be accomplished unless you make a noise about it. Two ways are open for this purpose. Intensive advertising and first-class travellers. But to confine either within the limits of this country would be only a half measure. They must be carried abroad, and particularly to the Dominions, where the most promising territory exists.

International Trading.

In considering these matters I feel that much could be accomplished by a meeting of prominent foundry proprietors who are interested in supplying material abroad, to discuss the possibilities of sending out between them a small commission of able men who will not only advertise their goods, but will seek out further opportunities of trade expansion. It is quite appreciated that tariffs may present almost unsurmountable barriers, but it is probable that an amalgamation of interests would find sufficient trade to warrant the laying down of works on the spot.

Advertising.

Consideration to advertising methods is another vital and important matter, and I suggest, particularly with reference to foreign trade, a mutual scheme for dealing with all steel foundries, *i.e.*, that a volume could be issued which would contain advertisements in prominent form of all steel foundry products produced in this country. All would contribute, and their prominence determined by their rates. I am convinced that such a volume would constitute a reference book for the Dominions for all the home steel production.

The same principle could be adopted for the iron foundries, brass and aluminium foundry products. A round table discussion would be the medium for stimulating thoughts and ideas from which all would profit.

The Technical Press.

We have an instance of future demands brought home to us by the enlarged Foundry Trade Journal, which is able now to deal more extensively with non-ferrous matter. This has been done through a recognition of the fact that to be thorough, they must cater and provide for all classes of the foundry world, and I congratulate them heartily in their anticipation of future demands in the immediate present, and I would like to take this opportunity of extending congratulations to all connected with this Journal—perhaps in particular our Past-President, the Editor—on the progressive spirit shown, and for all the valuable work that he has done in advancing and promoting, through its pages, the interests of British foundries and foundrymen. At this point may I venture a suggestion, to which I have given some thought, and through which we might help the Mother Country to get into more intimate touch with the Empire—this is that we should institute an "Empire Foundry Journal," issued quarterly, which should include the more important Papers on all metals, steel, iron, brass and aluminium, and also be an advertising medium for purely British goods. To make my point *re* advertising quite clear: we must boost our goods. To sit and wait for orders coming in is an old-fashioned method. The business man of the future will go out and bring them in. It is useless to wait and to watch: other countries are picking up trade which is obviously ours for the sake of a little effort. Business firms which are prepared to send men out will get trade, and will always get a return on the money so spent. We have all felt the strain of the most critical financial and commercial period that this country has ever experienced, but this period also stands out as one of the most striking tributes we could possibly have to our national stability. I doubt if any other country could have recovered and weathered such financial obligations in the manner in which this country has. With a more settled spirit in the country we can be more optimistic about the future, and it is in this spirit of optimism that I appeal to all those interested in the foundry to do their utmost in contributing their share of effort to bring about this increase in trade and output, for it is only by increasing trade that we can hope to increase our earning capacity, and we must be inspired by a mutual desire to share in giving as well as in taking.

My object has been to try to arouse a realisation of the possibilities which lie before us in the foundry and what, in spite of all that has been done in the past, still remains to be accomplished. We are faced with difficulties and problems, but it is only by taking up a bold attitude that we shall and must attack and overcome them rather than to be placidly content to leave them for others to master.

Polish Blast-Furnace Union.—A meeting recently took place at Warsaw for prolonging the agreement among the Polish blast-furnace plants and extending the Union's export activity. The discussion was to be resumed at a subsequent meeting.

The Manufacture of Cast-Iron Tubbings for Mine Shafts.*

By H. Becker, Düsseldorf.

In July last shaft No. 3 of the Auguste Viktoria mine at Hüls, Germany, which had only recently been finished, was completely destroyed by an incursion of water. It appears that the accident was probably caused by the rupture of the cast-iron tubbing, due to powerful subterranean forces arising from rock displacements. Although such an occurrence is rare in Germany it serves to show the importance of suitable construction, stability and strength in mine shafts. The following remarks dealing with cast-iron tubbings, which are those most generally in use, may therefore be found worthy of special attention.

When a shaft is sunk through aquiferous rock strata the tubbing itself must be watertight. It must be connected to solid rock and be carried above the highest level of the underground water. In such shafts cast iron has been found specially suitable for the tubbing ever since the middle of last century, when the first trials of it were made. Originally rings cast in a single piece and flanged together were used, their maximum diameter being 4.4 m. in order to conform to the limit of the traction facilities on the railways (Fig. 2). Later, when the sections of shafts increased, the rings had to be divided into several pieces. At first the joints were not machined, *i.e.*, just rough castings were used, these being tightened by driving in wooden wedges or packed by inserting lead, iron mastic, tarred tow, etc. For moderate depths this type of construction was adequate as regards strength and watertightness, particularly if—as was the practice later—the separate parts were further secured or packed by screwing and by cast-on contact surfaces which were afterwards machined by hand. For great depths, however, in order that the separate parts should fit accurately together as well as against the adjacent rings, and particularly in view of the increased pressure of water and rock, careful machining of all the packing surfaces became necessary. The superimposed rings now form a cast-iron pipe of large diameter, and this has been found superior to all other types of tubbing from the point of view of watertightness and resistance to pressure.

Combined shaft rings of the same kind are still used to-day, although the form of the cross section (Fig. 3, 1-4) sometimes differs a little. The former are flat and have the flanges and ribs outside, while their connecting surfaces are not machined. They are packed by inserting flat pieces of wood or by driving in wedges. German tubbings, on the other hand, show no projections of any kind on the outside facing the wall of the shaft, and are provided with accurately-machined contact surfaces packed with layers of lead. There is also a considerable difference in height. While the English tubbing is 0.6 to 0.7 m. in height the German is generally made to the height of 1.5 m. In view of the difficulty in packing, however, English tubbing (in Germany) is practically no longer used.

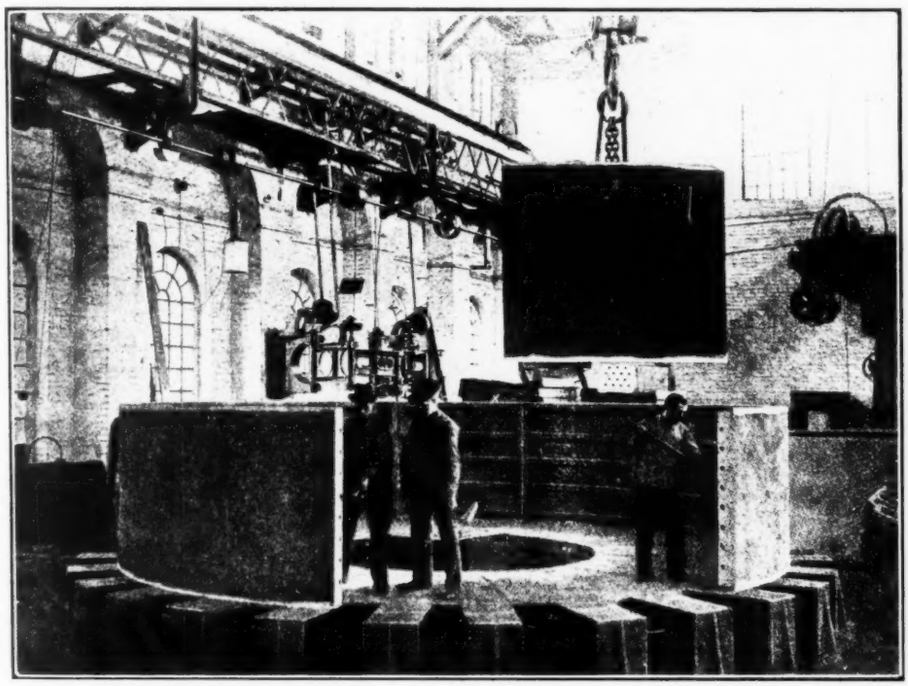


FIG. 1.—ERECTING TUBBING SEGMENTS.

The literature on the subject contains full particulars for ascertaining the required wall thickness of cast-iron tubbing, and this is of special importance in view of such accidents as that mentioned at the outset. The stresses occurring are compressive stress and transverse stress. The former arises from the pressure of water acting on the tubbing column and loading the rings radially, this pressure being 1 kg./sq. cm. per 10 m. of shaft depth. If the shaft has to be sunk through quicksand a considerably higher static pressure, governed by the specific gravity of the mixture, must be allowed for. Taking into account the water pressure alone, the following are the wall thicknesses obtained for a shaft diameter of 5 m. and a permissible compressive strength for cast iron of 1,000 kg./sq. cm.:—

Depth of shaft.	Wall thickness.	Depth of shaft.	Wall thickness.
m.	mm.	m.	mm.
50	12.5	300	75.0
100	25.0	350	87.5
150	37.5	400	100.0
200	50.0	450	112.5
250	62.5	500	125.0

As a perfectly sound casting is absolutely necessary for the resistance of tubbing, while for technical reasons its soundness is jeopardised if the wall thickness is excessive or too little, a lower limit of 30 mm. and an upper limit of 120 mm. for the wall thickness should not as a general rule be exceeded. These values must be increased according to the difficulties presented by the rock. If there are extensive workings in the vicinity of the shaft—as well as in other circumstances—rock displacements may occur which may subject the shaft tubbing to additional and irregular strains, the greatest of which cannot be determined. In this case transverse stresses are introduced into the column of tubbing, generally causing unilateral bulging and, owing to the high-tensile stresses occurring on the inside of the flanges and walls—which cast iron is incapable of withstanding—leading to the rupture of the tubbing.

FIG. 2.—SINGLE PIECE TUBBING CASTING.

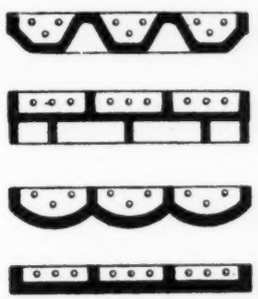


FIG. 3.—VARIOUS SECTIONS USED FOR TUBBING.

A remarkable case of bulging in the tubbing rings of a German potash shaft is mentioned by Riemer and Humperdinck. In this case a difference of 145 mm. in the diameter had been caused as a result of unilateral external pressure. Strangely enough, notwithstanding the high transverse stress in the wall of the casting which must necessarily have occurred, no cracks or other signs of overstrain appeared. The part that had given way was stiffened with an iron stay, and since 1913 no further trouble has occurred up to the present. This case shows that under special conditions cast iron is capable of taking up bending stresses far beyond the calculated values.

* Translated and Extracted from "Technische Blätter."

It has been proposed to use cast-steel tubbings for shafts of great depth and for the purpose of increasing their resistance to these transverse stresses. It must be objected, however, that this material possesses no greater compressive strength than cast iron. Moreover, the tightness of a tubbing is primarily dependent upon that of the vertical flange connections and the tensile strength of the bolting. The former, however, does not even enable the tensile strength of cast iron to be fully utilised, so that for this reason alone the use of cast steel for tubbings must be regarded as uneconomical.

As already stated, German tubbings are provided with machined flanges. In the early 'eighties special guiding lines were laid down for the construction of the first cast-iron tubbing for a potash shaft, the more important of which were as follows:—(1) Inner flanges are to be used, which must be machined most accurately over the entire bearing surface; (2) turned bolts are to be used for the connections, and these must fit with slight play into the bolt holes, which must be accurately bored; (3) the flanges are to be packed over the whole width of their surface by the insertion of strips of soft lead; on the inside the joints are to be caulked; and (4) the bolts are to receive special packings by the insertion of lead beneath the heads and nuts.

During the past forty years a large number of shaft tubbings have been constructed on these principles in Germany and other countries, and, with the exception of only two cases, have answered all requirements. The principles cited show that the individual segment castings require elaborate machining, especially as in many cases special holding grooves have to be sunk in the packing faces to secure the lead packing. It was soon recognised that, in view of the large number of castings which—apart from certain rings of special form, such as wedging cribs—have precisely the same form, special machining plant was necessary in order to place the manufacture on an economic basis. The machining of tubbings may therefore claim to be one of the first series, or, rather, mass-manufacturing processes in connection with large castings.

Fig. 4 shows a stock of finished segments. In Germany the external surfaces (of the segments) are generally smooth. The inner surface has connecting flanges running all round and powerful transverse ribbing. The horizontal connecting flanges are stiffened with one or more knee brackets (the figure shows that). In accordance with the principles mentioned above, the following machining processes are necessary:—

Machining of the Separate Segments.

(*a*) Machining the vertical (radial) connecting flanges; (*b*) boring the holes for bolting the flanges; (*c*) milling the contact surfaces for the head and nut of the fixing bolts (with many types of tubbing this part of the machining is dispensed with, as the packing of the bolt holes is effected with lead rings which are pressed against the bolt shafts by conically-bored washers); and (*d*) cutting or planing the packing grooves in the vertical fitting surfaces.

Machining of the Completed Rings.

(*a*) Machining of the horizontal connecting flanges; (*b*) making the packing grooves in these surfaces; (*c*) boring the fixing holes in the flange; and (*d*) milling the contract surfaces for the head and nut of the fixing bolts (as before).

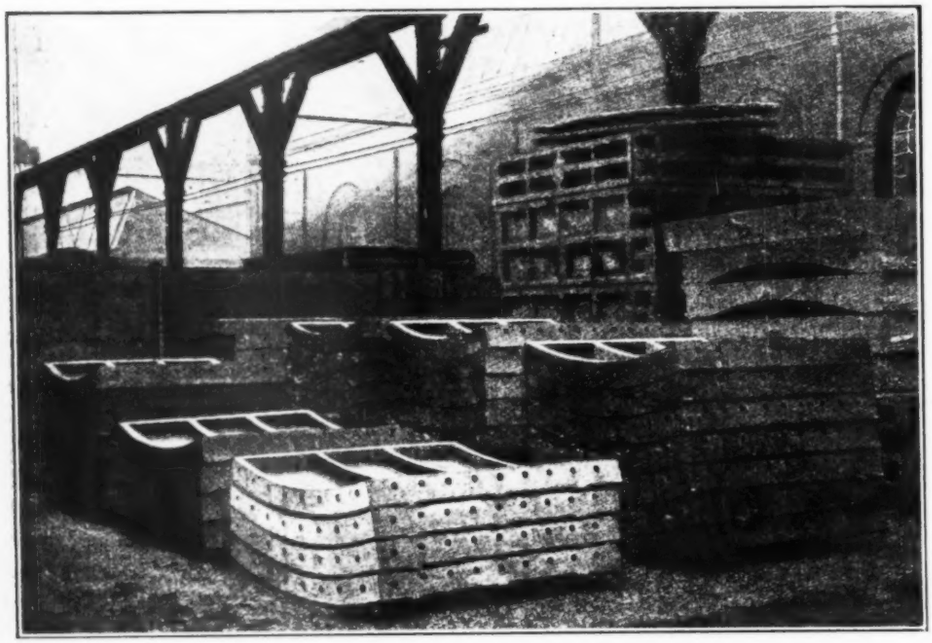


Fig. 4.—A Stock of Finished Segment Tubbings.

The machine tool industry in conjunction with the works manufacturing tubbings very soon produced special machining plant for these purposes. At first these machines were of a very simple nature, as was to be expected from the position of machine tool construction at the time. In course of time, however, they were greatly improved, and some of them at least may now be regarded as perfect in their operation.

Problems of the Steel Trade.

Sir Wm. Larke on the British Attitude.

Sir William Larke, Director of the National Federation of Iron and Steel Manufacturers, addressed a meeting of the Commerce Society of the London School of Economics on Tuesday on "The Development of the International Steel Cartel."

Defining the British attitude towards the cartel, Sir William said:—"We are fully conversant with everything that happens. They are willing to take us in on their own terms, but they are not the best terms. I am quite clear in my own mind that the British iron and steel industry was right, in the existing circumstances, to wrestle with its own problems, heavy and almost overwhelming though they are.

"I am often told, 'Oh, if you give it time the economic situation will right itself.' But I don't want to give it time. I want to see it righted in my own life, not simply in the life of my grandson."

Sir William Larke denied that trustification implied the bolstering up of uneconomic plants at the expense of the industry as a whole. "Germany," he said, "is the most highly trustified country in Europe. Yet in their own steel cartel they have closed down a number of works because it paid them to do so. After all, you must allow for industrialists the same measure of common sense that you possess yourself."

Warped Castings.

By J. M.

To what extent is the foundryman to blame for the distortion of castings after they have been machined or even erected? In most cases he is not to blame at all because, even in jobbing foundries where the conditions are somewhat different from repetition foundries, chills are used where necessary and every precaution is taken to ensure that the cooling of the metal is at a uniform rate throughout the entire casting. This may be done primarily to reduce the risk of making a "waster," but it also lessens the liability to distortion, subsequently to machining. The experienced moulder—and especially is this true of large delicate work—will add additional machining allowances on certain top faces because of the possibility of dirt. The subject of camber is more or less involved in the subject of distortion, but when every possible factor is taken into consideration castings will frequently become badly warped after surfaces have been broken with machine tools. Although the subject then becomes primarily an engineer's problem it is still of interest to the man who was responsible for the production of the casting.

Engineers will sometimes talk of well-seasoned cast iron as though it were timber. The seasoning of timber has fairly accurately been described as a process, either natural or artificial, whereby all superfluous moisture contained in it is extracted, and the grains or fibres of which it is composed change their position, become more closely united, and re-arrange themselves in a new order. This change may tend to convert a plane surface into a curve, may alter its shape and form, but when once it has assumed this condition, as a result of seasoning its form will remain permanent. It can be sawn and planed and, allowing that seasoning can never be perfect, will not change its shape. In the case of grey cast iron, the seasoning must be somewhat different. When cast iron rearranges itself in the process of cooling from a liquid to a solid it would necessarily solidify in varied stages of progression; thus would there be set up internal and external stresses, these being more or less affected by the formation and shape of the solidifying block of metal. Many of these stresses might be so confined that their imprisonment would be permanent even after complete cooling and shrinking. But though effectually confined, these stresses are, however, never actually quiescent. They may be imprisoned for years, but all this time they will be striving to let themselves loose, and often in their attempts at liberty they will exert sufficient force to bend and warp—even fracture a solid mass of iron weighing, perhaps, many tons. Thus if we can conceive a piece of cast iron from which all the internal stresses have escaped, then might we compare it with a piece of well-seasoned timber, in that it will be quite at rest, not tending to depart from its shape and form.

When the cost can be incurred, a wise procedure is to rough machine, *i.e.*, take a heavy cut, put the casting aside for a few weeks or months and then machine finally. Sometimes the machineman distorts a casting by wrong clamping to a machine bed or a lathe chuck. In a contemporary, recently, an instance was given of a fragile ring that had to be bored out, and it was stated that the usual procedure would be to rough-machine the ring, which would require heavy machining and then allow it to stand for a period to season before being finished. As the finish cut would be light, only light clamping would be necessary, consequently the ring would not be distorted when being finished. Actually seasoning was unnecessary and the complete machining operation might have been done without any waiting interval. Incidentally, the foundry is sometimes blamed for machine-shop errors.

Pig-iron in Manchuria.—The Anzan Steel Works, owned by the South Manchuria Railway Company, is planning to increase its pig-iron output from 200,000 tons a year to about 500,000 tons by the erection of additional blast furnaces.

Foundry Purchasing—XVI.

By Eric N. Simons.

Whatever the character of the material required for use in the works, especially in the manufacturing departments, those who supply it should be instructed to conform to certain definite requirements. These are best set forth in the form of a definite specification, which may either be copied word for word on each order as issued, or may form the subject of a separate sheet or sheets, printed, numbered, and attached to each order for the guidance of the supplier. In the following articles some remarks will be offered on the subject of specifications in general; here it is necessary only to consider them from the angle of their value as data. The record clerk should keep folders containing copies of every specification. These folders should be classified and numbered, according to the character and class of material affected. As has been pointed out (see previous articles), there are four main groups of commodities: Those for re-sale, those for works repairs and maintenance, those for use in direct production, and those for office use. A simple method of filing specifications is described in the following lines.

Classification by Groups.

Each main group is given a key letter. Thus, raw materials for production use are called Group A. These materials are then classified into sections 1, 2, and 3. Section 1 consists of those materials bought locally; section 2, of those bought elsewhere in Great Britain; section 3, of those bought outside the British Isles. Pig-iron would thus be in Group A, section 3, assuming it were imported. British pig-iron would be in Group A, section 2, unless the foundry concerned were situated in a pig-iron manufacturing district, when it would be in section 1. Separate sub-divisions are now made to accommodate the various groups of commodities in themselves; *e.g.*, sands, non-ferrous metals, refractories, etc. Each of these sub-divisions is given a separate small letter. Pig-iron, to keep to the example chosen, falling into the ferrous metals section, would probably be lettered Group A, section 2, sub-division (c). Each member of these sub-divided groups has its own individual number. Finally, the specification for pig-iron would be found, perhaps, as No. 2 in sub-section (c). The specification itself would be numbered thus: A.2/(c)2, or, more simply, A.2.c.2. This number would be carried by all cards affecting pig-iron, and would be quoted on all orders. If at any time modifications or changes were made to the specification affecting any commodity, or if it were found necessary to draw up a completely new specification, a further addition would have to be made to the key-letters or numbers. The simplest plan would be to draw a line under the whole, and put the number of the edition of the new specification below. Thus, if the specification concerned had been revised for the third time, the revised issue would carry the number $\frac{\text{A.2.c.2.}}{3}$ This is important, for reasons that will be explained later.

Alphabetic Classification Discarded.

Some reader may argue that far simpler than this numerical and group classification would be an alphabetical file, each specification being filed according to the order of its name, *e.g.*, pig-iron being filed under P, and oxygen after oil, and so forth. The disadvantage of this method, outwardly simple, is that in reality it involves filing a specification for every single commodity; whereas, in practice, it is found that sometimes one specification will cover a small group of allied products. From the tool-steel hardener's point of view, for example, a hardening oil must possess certain qualities, *e.g.*, high-flash points. But if it possesses these qualities which make it suitable for hardening, its exact constitution is unimportant. Cottonseed oil, fish oil, whale oil, linseed oil, are all used in hardening steel, and conceivably the one specification (filed under "Hardening oils" in a particular group, or even under "oils," if the right sub-division into lubricating and hardening oils was made) might cover them all. The alphabetical classification would involve filing one specification under "cottonseed," another under "whale," etc.

How Costly Mistakes Arise.

The advantage of filing these specifications is that it enables the buying department to safeguard itself against error. For example, an order clerk, confronted late in the afternoon with a requisition from the works for a certain commodity, might forget or be unaware that the material was required to comply with certain physical or mechanical tests, as embodied in a detailed specification. The order might go forward without any definite specification or analysis being indicated as necessary. The supplier would, in the circumstances, supply his ordinary run of material, which might or might not give the needful tests. On being delivered, if it failed to pass these, it would be rejected out of hand. The order would be turned up, and the absence of a specification would be discovered. The result might be a severe loss. But when the specification file exists, the requisition, before going forward, is passed to the record clerk, who consults his file in order to see whether any standard specification applies to the commodity concerned, and if so, indicates on the requisition slip the corresponding number. This is repeated on the order, so that the supplier's attention is inevitably drawn to it. If no such file exists, the possibilities of omission or error are multiplied. As has been suggested, if the day had been a busy one, and the order clerk were rushed, he might not have the time to spare to hunt up the files or consult the production department concerned in regard to a possible specification. On the other hand, he might ring up the works, only to find that the manager was out, or had gone, or was undiscoverable, while none of his subordinates could answer his questions. In these circumstances, rather than hold the order back, he might chance it, intending to confirm or correct his omission in the morning. But in the morning he might forget, with the result intimated.

There is another advantage in the maintenance of a file of specifications, namely, that the buyer is able to turn up quickly, in conversation with salesmen, an exact indication of the requirements certain commodities have to fulfil, which makes it unnecessary to consult the production or other departments at every end and turn.

It may be imagined that the omission of a specification from an order is too remote a possibility to make it necessary to keep an up-to-date file. Even if this were so, it must be remembered that it is not always the frequency of a mistake that matters, but its gravity when made. For example, in despatching goods overseas, one insures against various risks, though the frequency with which loss through one or other of these risks is incurred is small. Nevertheless, the loss, should it occur, is so serious that it warrants the recurrent expense of insuring. Similarly, the risk of an order being despatched without a specification is not great, but should the error be committed, the consequences may be so serious that the additional labour of keeping a file of specifications is warranted. In some establishments it is the rule for the works departments and others, when requisitioning materials, to indicate the number or character of any desired specification on the requisition slip. But requisition slips are often made out by works clerks or under-managers from hastily scribbled notes made by their superiors, and in no case can it be guaranteed that the specification will never be left off. Where this system is in vogue, in fact, the error is even more likely to be repeated right through than when the responsibility for inserting specifications rests with the buying department. Instances have been known where departmental managers themselves have forgotten the all-important specification, and the omission has been taken by the order clerk in the buying department to be intentional. When the specification file is kept, it is one person's definite task to see that specifications are included wherever necessary, and he can only omit one as a result of downright neglect of his work.

Reports to be Filed Alphabetically.

In similar manner, all tests, reports, or comments, on raw materials and other goods tried out, used consistently, or used intermittently, should be filed. Here, the alphabetical classification is better, because reference is rather to individual suppliers than to particular classes of goods. For example, the buyer, offered a brand of belting at, say, a lower price than he is paying, will wish to know not so much how his belting in general is faring in the works, as how Smith's or Brown's or Robinson's belting is faring. He may use several different brands, and if he has to drop one to secure a better price, he may have a particular firm in mind. The record of the performance of this particular maker's belting is what he needs at the given moment. At the same time, the possibility that he may forget the particular maker's name has to be borne in mind, and therefore it is advisable, while having the reports and tests filed alphabetically under suppliers' names, to insert cross-references to particular classes of goods, as shown in Fig. 1. As will be seen, these cross-index cards carry existing suppliers' names, which refresh the memory, enabling the right file of reports to be turned up. If this cross-index is considered unnecessary, the purchase-record cards described in previous articles can be used for the same purpose, *i.e.*, as a mnemonic.

Oil, Lubricating.—B Quality.

Suppliers.	Town.

FIG. 1.—CROSS INDEX CARD FOR REPORTS.

Lancashire Junior Foundrymen Visit Sheepbridge.

On October 29 some 35 members of the Lancashire Branch Junior Section visited the works of the Sheepbridge Coal & Iron Company, by invitation of the Company. The party was met at Chesterfield Station by Mr. Goodwin, the President of the Institute, and was conveyed to the works in a motor 'bus provided by the Company. A complete tour of the works was undertaken under the guidance of members of Mr. Goodwin's staff.

At the conclusion of the visit the party were conveyed back to Chesterfield, and were entertained to lunch at the invitation of Mr. Goodwin.

The President of the Section, Mr. T. Makemson, proposed a vote of thanks to the Sheepbridge Company, and also to Mr. Goodwin for his hospitality in entertaining the members of the Section. The resolution was seconded by Mr. J. Burgess, the Joint-Secretary of the Junior Section.

Mr. Goodwin expressed the pleasure of the Sheepbridge Company in having the opportunity of showing the members round their works, and also expressed his own pleasure at the opportunity of entertaining the members of the Junior Section. He pointed out the advantages which membership of such a Section confers upon its members, and urged upon his hearers to transfer to the Senior Section of the Institute when the opportunity arose.

Tunnel under the Straits of Gibraltar.—At a recent meeting of the French Academy of Sciences a scheme was submitted for a tunnel between Spain and North Africa, prepared by Señor C. Ibanez de Ibero, a Spanish engineer, along a line where the depth of the sea would only be 396 m. (say 1,320 ft.). The length of the proposed tunnel would be under 53 km. (say 33 miles), of which 32 km. (about 20 miles) would be under the sea.

Foundry Practice and the Design of Castings.

Mr. T. Makemson, addressing the Wales and Monmouth Branch of the Institute of British Foundrymen at Cardiff Technical College on October 22, said that all foundrymen could bring to mind examples of castings in which slight alterations of design had made all the difference between a casting which was difficult or almost impossible to obtain soundly, and one which was comparatively easy to make. He quoted several characteristic examples of such designs, and suggested how they could be improved by slight alterations.

There were, he said, several directions in which design increased the difficulty of the foundryman. (1) Castings were continually becoming more complicated, due to the developments of modern engineering; (2) the necessity for reducing machining; (3) unequal sections and abrupt changes of thickness; (4) the position of ribs and other internal parts of the casting which set up stresses during cooling; and (5) the need for accuracy and uniformity, particularly in repetition work.

Referring to the tendency to save machining by reducing the number of joints which have to be machined and parts bolted together, the lecturer said that whilst praiseworthy in itself, this frequently added considerably to trouble involved in making the casting, and, furthermore, to set up internal stresses in the casting with consequent risk of fracture.

He showed several lantern slides illustrating castings of complicated shape which had been redesigned in the form of two or more simpler castings, the result being a decrease of risk in the foundry without any increase in the overall cost.

Examples were given of a number of castings used in Diesel engine and electrical work, where sponginess had been found due to sudden changes of section. It was pointed out that in some cases these troubles had been cured by the use of denseners, though this remedy was not advocated, except as a last resort. Examples were given where even more effective remedies had been found by a slight alteration to design and by changing the method of running and the position and size of the risers.

The lecturer stated that it was a frequent complaint on the part of the foundry that the machine shop was too exacting with regard to the accuracy required in the castings. He added, in order to reduce machining costs, the foundry must supply reasonably accurate and uniform castings, particularly in repetition work, in order to enable the castings to be fitted in the jigs. As an example he quoted the importance of uniformity in resistance grids as used in electrical engineering. It had been found that when these grids were made by two different men, one of whom rammed hard and the other soft, a difference of 10 to 12 per cent. was found in the resistance, due to the soft rammed casting having swollen to a larger size than the hard rammed one.

It was pointed out that in repetition work the amount of machining should be kept as small as possible, consistent with obtaining a clean surface. The pattern maker who left "plenty on" for machining would frequently add considerably to the cost of production. Plate moulding and machine moulding assisted materially in work of this kind, and the foundryman usually had little difficulty in working to the accuracy required.

Several lantern illustrations were given, showing examples of castings which had fractured owing to internal stresses which had been set up in the castings when cooling, and remedies were suggested.

The lecturer recommended that the closest co-operation should exist between the foundry and the pattern shop, and that a representative of the foundry should give a lead with regard to the general method that it was intended to follow when moulding any given job.

It was not always realised how much the pattern maker could do towards eliminating chaplets and excessive sprigging of cores by making prints sufficiently large to give an ample bearing surface. The pattern maker could also assist towards the reduction or even the elimination of drawbacks and loose pieces. Reference was made to the alterations in moulding methods which have been brought about by the extensive use of oil sand cores.

In conclusion, it was pointed out that it was desirable for close co-operation to exist between the designer on the one hand and the foundry and pattern shop on the other. One had to keep in mind the final cost and general efficiency of the product. If, after consultation with the designers, it was found that awkward designs were necessary, then it was the foundryman's job to produce the awkward castings, and it would be said, to his credit, that the foundryman generally did succeed in producing what he was asked for. It was only recommended that alterations could be made when it was obvious that they would decrease the risk and trouble in the foundry without adding materially to the overall cost.

Mr. Hird, in thanking Mr. Makemson, said that this was a subject which should be well thrashed out, especially with regard to co-operation between the foundry and drawing office. The old spirit was being eliminated, but far too slowly. He agreed that for Diesel-engine cylinders chills should be avoided. Sometimes they were essential and would help one out of a difficulty. He had in mind a job which he once did for Krupps. A cylinder, as illustrated, was cast on end. The first one made turned out satisfactorily, but the next two were spongy, and it was found necessary to fall back on chills. A series of metal chills were built up round the core "A." They had to be wired to keep them in place. The patternmaker asked whether he should remove the wire, but it was thought it would not hurt the casting, but when machined up, the binding wire was still there and the job was scrapped.

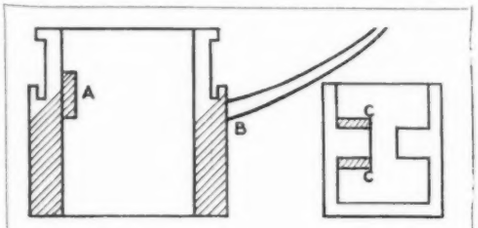


Fig. 1.

Fig. 2.

All were top poured. Mr. McClelland asked what would be the thickness between the top and bottom section?

Mr. Hird replied that the bottom would be somewhere about 1½ in. and the top 1 in. thick. The rest of the casting was not spongy and the casting was bored right through.

Mr. McClelland said that according to Mr. Makemson's reasoning it would be natural for the lower part of the casting to have shrinkage holes, and Mr. Hird suggested one would not get spongy places at the bottom of necessity, but rather where the section changed.

Mr. Makemson said that if he had given the impression that spongy places were bound to be found at the bottom, he had not intended to do.

Mr. Hares thought that if it were poured through the thick end it would obviate the difficulty. From general experience it appeared the job had been cast upside down.

Mr. Hird stated there had been a special reason for casting the job as illustrated. Another experience he thought might prove of interest. This was the casting of piston bosses as shown in Fig. 2. Coring out was practically impossible, so a chill like a collar was rammed up in the core "C." Chills always left a mark, but there were times when they had to be used.

Mr. Kinsman asked was the mould as Fig. 1 jointed, and was it not possible to put a riser and feed at point "B"? Mr. Hird thought, however, this could not be done without considerable trouble.

Mr. Hares asked whether Mr. Hird had found porosity in the bore of the motor cylinder, and was informed this was so where the flanges came and at the head.

Mr. Hares mentioned that when similar work was being done, instead of ramming the bore holes up in the sand, a perforated tube had been used and this had reduced porosity by one per cent.

Mr. Hird thought it was a question of how much porosity was due to the metal and how much to gases. There was a very close border line between spongy places due to gases and metal. Mr. Longden had been taking up the line that much was due to gases. The efficiency of the chill is its ability to extract heat from molten metal.

Mr. Makemson mentioned that it required some experience to decide the size and dimensions of a chill, but he preferred to eliminate them altogether, Mr. Hares adding that chills often spoilt castings.

Mr. McClelland asked was it a fact that in the case of moter cylinders it was necessary to use a higher phosphorous iron and that the more phosphorus, the less susceptible was the casting to the effects of a chill?

Mr. Makemson replied that for internal-combustion work he did not like high phosphorus. For thin castings it provided a very fluid metal which was not altogether suitable for internal-combustion work. Fluidity should be obtained by high silicon rather than high phosphorus.

Mr. Hird thought that metal containing 0.5 per cent. P and 2.0 to 2.5 per cent Si was suitable for an air-cooled cylinder.

Mr. McClelland asked was it more difficult to machine a cylinder casting with a head on? Mr. Makemson thought it would be. Certain Continental firms were making Diesel engines with heads on and machining was said to be reduced to some extent, but English makers do not follow this practice. It does not actually reduce machining costs. It might reduce the machining area, but it is a more difficult job.

I.B.F. Activities in Wales and Bristol.

Efforts have recently been made to extend the interest in the work of the Institute of British Foundrymen in the South Wales and Bristol areas. Mr. T. Makemson, the General Secretary of the Institute, has recently been in the area, and has called upon a large number of foundries with a view to enlisting the interest of the directors, managers, and also the foremen and workmen.

On October 22 Mr. Makemson lectured to the Wales and Monmouth Branch on "Foundry Practice and Design," a report of which appears on this page.

On Monday, October 24, a meeting was held in the Grand Hotel, Bristol. It was presided over by Mr. Ben Hird, President of the Wales and Monmouth Branch of the Institute, and was addressed by Mr. J. Ellis, Past-President of the Institute, Mr. J. J. McClelland, Mr. Hares, and the General Secretary. It is probable that the membership of the Institute will extend in the Bristol area in the near future, and the Wales and Monmouth Branch has already made preliminary arrangements to add two extra lectures to its syllabus during the coming session, these lectures to be given in Bristol.

On October 25 a meeting was held in the Bristol and South Wales Hotel, Cardiff, at the invitation of the Cardiff Branch of the National Union of Foundry Workers. Mr. Young, the President of the local Branch of the Union, presided, and addresses were given by Mr. Ellis, Mr. Makemson, and Mr. Hird, the President, and other members of the Wales and Monmouth Branch of the Institute. A similar meeting was held on the following evening, at the Club House of the Newport Branch of the National Union of Foundry Workers, and this meeting was also addressed by the speakers who took part in the Cardiff meetng. It is felt that these two meetings with the local branches of trade unions have done much to remove the misconception of the objects of the Institute, which have undoubtedly existed in some trade union quarters.

Are You Satisfied with Your Moulding Costs?

IN YOUR FOUNDRY YOU WANT TROUBLE-FREE PRODUCTION, ACCURACY, SPEEDY OUTPUT, LOWEST POSSIBLE OPERATION AND MAINTENANCE COSTS

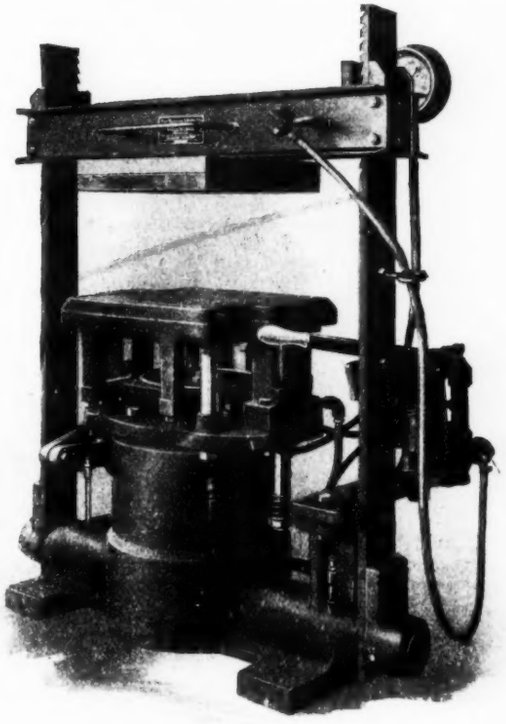
TABOR MOULDING MACHINES

(FOR EVERY CLASS OF WORK)

ENSURE THESE RESULTS

Accurate Definite Draw with Permanent, Accurate Alignment.

All Operations Controlled by One Lever.



All Moulds squeezed alike to whatever Pressure Required.

Accuracy of our Jigs ensures perfect Interchangeability and accurate closing of moulds.

The above illustrates the TABOR POWER SQUEEZING "SPLIT PATTERN" MOULDING MACHINE, specially suitable for all small patterns which can be split in halves or for flat back work

WE ARE

SOLE SELLING AGENTS and MANUFACTURERS of

TABOR MOULDING MACHINES

Capacities and Dimensions furnished upon application:

MACNAB & CO.

56/8, Eagle St., Southampton Row, London, W.C.1

Trade Talk.

DORMAN, LONG & COMPANY, LIMITED, propose to put into operation another blast furnace on the production of Cleveland pig-iron.

THE SHAREHOLDERS OF the Bede Metal & Chemical Company, Limited, have confirmed special resolutions to reduce the nominal value of the shares from 20s. to 8s. each.

THE PONT-A-MOUSSON Iron Pipe Foundries have just obtained confirmation of a contract of 2,200 tons of cast-iron pipes to British Standard specification for Callao (Peru).

KITSON & COMPANY, LIMITED, of the Airedale Foundry, Leeds, have purchased the goodwill of the business of Manning, Wardle & Company, Limited, of the Boyne Engine Works, Hunslet.

AT OLDBURY, last week, John Wheeler & Sons, ironfounders and engineers, Clay Lane, Langley, were summoned for not having certain mill-gearing shafting fenced, and a fine of £5 was imposed.

SIR S. W. ROYSE & COMPANY, LIMITED, 20, Albert Square, Manchester, have come to an arrangement to represent the Duriron Company, Inc., of Dayton, Ohio, in the United Kingdom and Ireland, for the sale of their valves, fans, steam jets, pumps, pipes, etc.

INCLUDING THREE SHIPS which were launched during October, the output from the shipbuilding yards on the Wear for the ten months of the present year is 24 vessels, aggregating 103,905 gross tons. Last year the whole product was but eight vessels and 36,979 gross tons.

THE GRINDING AND pulverising offices of International Combustion, Limited, 11, Southampton Row, W.C.1, announce orders for one Raymond pulveriser and seven Hum-mer electric screens for England; one Hardinge conical ball mill for Ireland; and three Raymond mills for France.

ALFRED HERBERT, LIMITED, of Coventry, are supplying the pulverisers for the new super power station which is being erected at Hams Hall, near Birmingham. This station when completed will have a capacity of 800,000 kilowatts. There will be at the outset five boilers, each having a capacity of 200,000 lbs. of steam per hour. Each of the boilers will be fired by five large double Atritors, the double machine having a pulverising capacity of 4 tons of coal per hour, giving a total capacity of the plant of 100 tons per hour. The Atritors will be electrically driven, and all will be electrically controlled from a distant station.

THE CLYDE SHIPYARDS during October launched 20 new vessels, aggregating 72,685 tons. This output is the second highest ever recorded in the month of October. The outstanding tenth month was in 1924, when 84,186 tons were launched. During the first ten months of this year, 170 vessels aggregating 334,964 tons have been launched. In the first eight months of the year the total new tonnage was 205,160 tons; the combined output for September and October represents 129,804 tons. Up to October, 1926, 113 vessels of 254,849 tons had been launched, while the figures in the corresponding period of 1925 were 200 vessels, and 464,620 tons.

"THE STEEL INDUSTRY will not find salvation by reducing wages or erecting tariff walls," said General the Hon. Sir H. A. Lawrence, chairman of Vickers, Limited, when the Master Cutler, Viscount Cave, Admiral of the Fleet Earl Jellicoe, Mr. A. M. Samuel, Parliamentary Secretary, Overseas Trade Department, and a large number of guests visited the River Don Works at Sheffield. "A large percentage of steel and engineering businesses in Britain are ill adapted to compete under cut-throat conditions," he added. They exist, and simply carry on from day to day. Amalgamation on the right lines of like with like would save administrative expenses, secure financial stability, and the best brains and best administrative power in the country. I see no reason, under those conditions, why steel and engineering industries should not regain prosperity."

IN CONNECTION with the Second (Triennial) Empire Mining and Metallurgical Congress, Canada, held during August and September last, the Empire Council of Mining and Metallurgical Institutions has decided that a dinner be held in London to afford an opportunity of acknowledging the indebtedness of the Constituent Institutions to the Canadian Governments and people; and to review the results of the Congress, the importance of which to Canada and the Empire generally was universally acknowledged. This dinner will be held on Tuesday, November 22, at the Hotel Victoria, Northumberland Avenue, London, W.C., when the guests will meet the Hon. Peter C. Larkin, High Commissioner for the Dominion of Canada, the Right Hon. Sir Robert S. Horne, K.C., M.P., Honorary President of the Congress, and other distinguished guests.

FLUTED CAST-IRON STREET-LIGHTING COLUMNS have recently been supplied by the General Electric Company, Limited, Magnet House, Kingsway, London, W.C., for a street-lighting scheme in New Zealand. The columns are fitted with five-light bracket arms, supporting four 10-in. dia. frosted globes on the side arms, surmounted by a 12-in. dia. central globe. The height to the top of the centre globe from ground level is 13 ft.

MR. CHARLES FREDERIC SPENCER, the new chairman of Palmers Shipbuilding and Iron Company, Limited, referring to the idle steelworks plant, said that the iron and steel trade was regarded as essential to the life of the Nation, and he believed the day was coming when economic needs and regard for the Nation's necessities would bring about the recognition for the affording of assistance to the iron and steel industry in the great efforts it was making. If this help was not forthcoming he was afraid that many of the iron and steel works must remain partially or wholly idle.

THE INSTITUTION OF CHEMICAL ENGINEERS has been in existence only five years, but in that time it has already attained a high position among our professional and scientific institutions. There was a distinguished gathering present on the occasion of the Institution of Chemical Engineers' annual reception on Monday. Among the guests who were received by the President, Sir Alexander Gibb, and Lady Gibb were the Hon. Sir Charles Parsons, the Rt. Hon. Sir Alfred Mond, Bart., M.P., Sir Frank and Lady Heath, Sir William Pope, Sir John Flett (Director, Geological Survey of Great Britain), Sir Alexander Kennedy, Sir Ralph Wedgwood, Professor H. E. Armstrong, Mr. F. H. Carr (President, Society of Chemical Industry) and Mrs. Carr, Mr. W. L. Hichens, Mr. C. H. Merz, Mr. Emile Mond, Mr. Henry Mond, Mr. Robert Mond, Dr. J. H. T. Tudsbery (Hon. Secretary, Institution of Civil Engineers), Professor E. C. Williams (Ramsay Professor of Chemical Engineering, University College, London), and Professor J. W. Hinchley (Honorary Secretary of the Institution).

AT A MEETING of the General Waste Materials Reclamation Trade Board (Great Britain), recently held in London under the chairmanship of Mr. E. H. C. Wethered, the Board had before them a motion by the workers' side for the fixing of special rates for certain classes of male workers employed in the scrap metal section of the trade, and a motion by the representatives of employers for a general reduction in the minimum rates of wages at present in operation for all male and female workers. After discussion and after negotiation between the sides, a unanimous decision was reached that neither of the motions should be proceeded with, on the understanding that the minimum rates at present in operation should remain unchanged, and that no additional rates should be fixed for a period of at least twelve months. The Trade Board decided to make certain slight amendments in the present notices, in accordance with the proposals contained in their Notice DB (10), but to postpone the operation of the changes until such time as the Board could also deal with a slight modification which they had decided to propose in the present provision with regard to the six monthly advances to juvenile workers.

SOME INTERESTING FIGURES showing the necessity of scientific costing methods in industry were disclosed at the annual conference and dinner of the Institute of Cost and Works Accountants in London. Mr. W. Howard Hazell, J.P., who presided, said that it had recently been stated that only 20 per cent. of factories in this country had proper costing methods. Mr. W. L. Hichens, the chairman of Cammell, Laird & Company, Limited, pointed out that it was no exaggeration to say there was no really successful business in this country which had not got a highly efficient costing system. Sir Herbert Austin made an appeal for directors of concerns to give greater attention to cost accountants. Mr. J. S. Askwith, of Bolsover, said that it would be difficult to find in the 3,000 pits of the country 10 per cent. which took the trouble to control their valuable stores in the way they controlled their petty cash. Another speaker, Mr. Perry Keene, said that in his works, employing 12,500 men, operators who used to earn £4 a week were now earning £16 or £17 a week, with a corresponding reduction of costs. Selling prices had been reduced by 63 per cent. at the same time by a scientific costing system designed to improve methods and to eliminate waste.

IN HIS PRESIDENTIAL ADDRESS to the members of the North-East Coast Institution of Engineers and Shipbuilders, Mr. Maurice S. Gibb pointed out that the engineering industry has at present a greater capacity to produce than the consumers have the ability to buy its products. And yet, on the one hand, there are hundreds of thousands of people in the world wanting—yet unable to buy—more food, requiring more clothes and demanding more houses, the production of which would require more engineering products of one kind and another; on the other hand, there are hundreds of thousands of men and women willing and anxious to work to produce these commodities who cannot find employment. What is it that is preventing the ordinary economic law of supply and demand from operating in this case? The demand is there, but the supply does not seem to be able to operate sufficiently to satisfy the demand to the full extent. Stated briefly, the world is impoverished by loss of wealth due to the war, and this, coupled with a desire for less working hours in this country and a demand for better social services of one kind and another, all of which have to be paid for by industry in general, has the effect of so increasing costs that our export trade is crippled and our imports increased, on account of competitor nations producing cheaper than ourselves, with the result that the balance of our exports and imports is swinging in the wrong direction. The magnitude of the problem is made none the less by having to compete against tariff barriers, longer working hours, and less wages in vogue in competitor countries; added to this is the burden of rates and taxes which we have to carry, the like of which no industry in any other country has to bear.

Contracts Open.

Bristol, November 28.—Ten 2-ton electric movable roof cranes, for the Port of Bristol Authority. Mr. T. A. Peace, chief engineer, Avonmouth Docks, Bristol. (Fee £5, returnable, to be paid first to the General Manager and Secretary, Docks Office, 19, Queen Square, Bristol.)

Cairo.—Cast-iron pipes, elbows, etc.; 40,000 bolts, galvanised iron with nut and washer, 4 in. by $\frac{3}{4}$ in.; 50 kilometres wire, bronze enamelled; and 440 white metal die cast bushes for metallic packing, etc., for the Egyptian State Railways. The Inspecting Engineer to the Egyptian Government, Queen Anne's Chambers, Broadway, Westminster, S.W.1.

Cairo, December 1.—100 small iron money safes, 18 in. by 12 in. by 11 in., for the Egyptian Ministry of Finance. The Department of Overseas Trade (Room 41), 35, Old Queen Street, S.W.1. (Ref. B.X. 3,929.)

Dublin, November 12.—(2) Bolts and nuts, studs, rivets, etc.; (4) buckets, oilcans, etc.; (7) castings (ordinary iron), firebars, etc.; (16) hinges (wrought iron and brass), locks and keys, hardware (iron and brass), etc.; (18) iron sheets, bars (best Staffordshire), and tinplates; (24) steel forgings, mild-steel plates, bars, angles, tees and channels; (27) springs for engines, carriages, wagons, etc.; (30) tool steel, etc.; (31) tubes and fittings (iron), wire, wire work, etc.; (32) tubes (cold-drawn weldless steel) for boilers, for six or 12 months from January 1, for the Great Northern Railway (Ireland). Mr. F. C. Wallace, secretary, Amiens Street Station, Dublin. (Fee 1s. each.)

Dublin, November 14.—Steel pipes and castings, 24-in. and 18-in. diam., for the Borough Commissioner. The Borough Surveyor, 28, Castle Street, Dublin.

Dublin, November 16.—(1) Wheels and axles complete, and springs; (2) axle-boxes, complete; (3) body work, underframe work, brake work; (4) cast-iron work; and (5) roofing, for the Great Southern Railways. The Company's Stores Superintendent, Inchicore, Dublin. (Fee 5s. per section.)

Havant, Hants, November 28.—Three miles of 10-in. and 6-in. cast-iron mains, complete with sluice valves, etc., 780 ft. of 10-in. steel main and 110 ft. of 8-in. cast-iron main laid in duplicate, for the Rural District Council. Mr. E. T. Hildred, the engineer, 4, High Street, Gosport, Hants. (Fee £3, returnable.)

Johannesburg, November 17.—Tram track material, rail points and crossings, for the Municipal Council of Johannesburg. The Department of Overseas Trade, 35, Old Queen Street, S.W.1. (Ref. A.X. 5,364.)

Johannesburg, November 17.—300 street lighting steel poles, length 24 ft., for the Municipal Council of Johannesburg. The Department of Overseas Trade, 35, Old Queen Street, S.W.1.

Johannesburg, December 15.—Valve motion; wheels and axles, coupled; wheels and axles, bogie; crossheads, piston, etc., for the South African Railways and Harbours. The Department of Overseas Trade, 35, Old Queen Street, S.W.1. (Ref. A.X. 5,427.)

London, E.C.1, November 14.—Steel pipes and specials, for the Metropolitan Water Board. The Chief Engineer, at the Offices of the Board, 73, Rosebery Avenue, E.C.1.

"SERVICE GRC FIRST"

Steel Foundrymen, list not to the lure of the tempter, take specious sophistries for what they are worth, don't buy foreign sands with the idea that foreigners will buy your castings in return (what a hope!) and don't buy them from foreign steelfounders whose competition keeps your selling prices so low.

No, this country is, fortunately, self supporting in the matter of Sands.

"BUY BRITISH AND BE LUCKY"

You need not pay any more!!

WE BELIEVE THAT

"YORKSHIRE SAND"

IS THE BEST STEEL FOUNDRY SAND IN THE WORLD

BUT

AS WE MAKE AND SELL IT, AND MAY BE CONSIDERED BIASSED, WE DON'T ASK YOU TO TAKE OUR WORD FOR IT

WE REFER YOU TO THE DOZENS OF SATISFIED USERS WHOSE NAMES WE SHALL BE GLAD TO GIVE YOU

Do not forget the idea of ramming Cupola and Converter Linings with our STANDARD SHEFFIELD RAMMING GANISTER.

Fullest particulars and every help from:

General Refractories Co., Ltd.

SHEFFIELD.

Telephone: 22311. Telegrams: Refractory, Sheffield.

LONDON: 92, Cannon Street, E.C. GLASGOW: 58, York Street. PARIS: 31, Rue des Cordelières.

OUR MONOMARK BCM/GRC LONDON *IS AVAILABLE FOR USE.*

Iron and Steel Markets.

Pig-iron.

MIDDLESBROUGH.—In welcome contrast to the disheartening results of October trading, the outlook in the Cleveland iron market for the current month is distinctly brighter in tendency, both as regards home and export business, while much more optimistic views are entertained of still further expansion in the near future. The improvement thus suggested may be attributed largely to a gradual change in the Continental position. Prices abroad are very irregular, varying as much as 5s. per ton, but on balance Continental pig-iron prices for export are stiffening. Consequently it is no longer possible to buy good foreign iron on Tees-side at less than the local price, and, as home requirements are increasing, it is a substantial gain to make even the local market secure. Tees-side ironmasters adhere firmly to recent quotations, prices to home consumers being:—No. 1 Cleveland foundry iron, 70s. per ton; No. 3 G.M.B., 67s. 6d.; No. 4 foundry, 66s. 6d.; No. 4 forge iron, 66s. per ton. On sales to Scotland and abroad 2s. 6d. per ton discount is allowed.

In the East Coast hematite section there have been a few sales of East Coast hematite to Sheffield and South Wales, and also to Italy, but competition is extremely keen. Makers quote mixed numbers nominally at 72s. and No. 1 at 72s. 6d. per ton, but lower figures have been accepted for export orders. On the North-West Coast, Bessemer mixed numbers are currently quoted at 72s. per ton at works.

LANCASHIRE.—Consumptive demand in local markets for foundry pig is fairly well maintained for all leading brands, most of the leading Midland furnaces having satisfactory order books for deliveries during the current month. Quotations for Derbyshire No. 3 iron are firmly held at about 74s. per ton delivered locally, while there are offers of Staffordshire brands at about 73s. 9d. per ton, and of Cleveland at 80s. 8d., delivered Manchester.

THE MIDLANDS.—As many consumers have already arranged for supplies over the remainder of the year, business in the local iron markets is confined mainly to minor transactions, and is generally quiet. Prices, however, remain firm and unchanged, with Derbyshire No. 3 foundry quoted at 66s. and up at the furnaces, whilst No. 3 Northants varies from 60s. 6d. to 62s., and No. 3 Staffordshire 65s. at the furnaces. Cleveland and Lincolnshire are offered at 38s. 3d. per ton and about 80s. delivered respectively, and Scotch pig at varying figures from 90s.

SCOTLAND.—Little improvement can, so far, be noted in the conditions of the Scotch market for foundry material, but prices are fairly maintained at 72s. 6d. for No. 3 quality. Foreign foundry pig, however, is still obtainable a few shillings below the 69s. 6d. c.i.f. Grangemouth current for Cleveland iron, and consequently competition is acute for the few orders in circulation at the moment.

Finished Iron.

Conditions in this section of the manufacturing department continue unsatisfactory, most of the bar mills in the Black Country being extremely short of orders, and only partially employed. The price of crown iron is still a very unsettled factor. The quotations vary from £9 10s. in some directions to £10 5s. in others. Nut and bolt iron is offered in the region of £9, but few orders are being secured, as the bulk of the business for this class of iron must by force of circumstances go abroad owing to the wide difference in price, as the Belgian product can be obtained between £5 15s. and £5 17s. 6d. delivered Darlaston district. Staffordshire marked bars are quoted at £13 at makers' works, and although business is anything but brisk, orders are coming forward in better volume. In the foundry trade, makers of cast-iron pipes are securing good business as a result of cheapening production which enables them to meet foreign competition.

Steel.

Little change for the better can be reported as regards general conditions in the steel industry, although in home semi-products Sheffield makers are experiencing a more active demand for acid billets, but the slackness in basic billets, except soft qualities, continues, and is, in fact, rather more pronounced. There is an improvement in the demand for stainless steels, and makers of special steels have well-filled order books. Open-hearth steel business shows further contraction, and crucible steel is only moderately active. Motor-car steel is a good feature. Wire-rod business is slumping badly. In the tinplate market a fair amount of business is passing, and more inquiries are in circulation than have been experienced during the past few weeks.

Scrap.

Very little improvement can yet be noted in the general position of the scrap metal trade, though here and there a slightly more active demand for foundry material may be observed in particular localities. On the North-East Coast, for instance, the foundries are getting busier, and demand for heavy cast iron probably exceeds the supply, though parcels of machinery quality are still changing hands at 65s., and ordinary quality at 61s. per ton. In Scotland, machinery cast-iron scrap suitable for foundries is unchanged around 67s. 6d. to 68s. 6d. per ton, and for heavy ordinary cast-iron scrap 5s. per ton less. Old cast-iron chairs are still being offered around 65s. per ton; there has also been a better demand for light metal, and the price is still being quoted around 57s. 6d. to 60s. per ton, but the supplies available are limited. These prices are all per ton, delivered f.o.t. consumers' works.

Metals.

Copper.—The strongest section of the markets for base metals during the past week was again supplied in warrant copper, which has nearly approached the highest quotation of last year, closing upwards of £2 to the good on the week. Reasons have not been wanting to justify the strong upward tendency, which seems likely to develop further in the light of the stronger American statistical position as evidenced by the decrease in the American stocks within the last two months.

Official closing prices of standard copper have been as follow:—

Cash: Thursday, £58 12s. 6d. to £58 13s. 9d.; Friday, £58 5s. to £58 6s. 3d.; Monday, £58 10s. to £58 11s. 3d.; Tuesday, £58 15s. to £58 16s. 3d.; Wednesday, £58 15s. to £58 17s. 6d.

Three Months: Thursday, £58 10s. to £58 11s. 3d.; Friday, £58 1s. 3d. to £58 2s. 6d.; Monday, £58 6s. 3d. to £58 7s. 6d.; Tuesday, £58 12s. 6d. to £58 13s. 9d.; Wednesday, £58 15s. to £58 16s. 3d.

Tin.—In striking contrast to the progressive advance above recorded, the outlook in standard tin has become disappointing in the extreme, while, compared with the highest price of last year, cash metal has declined £63 per ton. Notwithstanding this, trading has not been very large. There was every indication of more satisfactory statistics being issued at the end of October, and this expectation was realised, as the figures revealed a decrease in the visible supply of about 460 tons. Very conflicting estimates have been circulated of prospective shipments during November and December, those varying between 12,000 tons and as much as 14,000 tons. America has been a fair buyer at more recent levels.

Official closing prices of standard tin have been as under:—

Cash: Thursday, £259 10s. to £259 15s.; Friday, £260 10s. to £260 12s. 6d.; Monday, £257 15s. to £258; Tuesday, £258 5s. to £258 10s.; Wednesday, £258 7s. 6d. to £258 10s.

Three Months: Thursday, £255 5s. to £255 10s.; Friday, £256 to £256 5s.; Monday, £253 to £253 5s.; Tuesday, £252 to £252 5s.; Wednesday, £252 5s. to £252 10s.

Spelter.—The market for ordinary spelter has also been irregular and easier, although the decline has not been heavy. The demand is on the small side, and while the makers on the Continent are endeavouring to maintain their position, some have been forced by circumstances to grant slight concessions in prices.

The following are the week's prices:—

Ordinary: Thursday, £26 6s. 3d.; Friday, £26 6s. 3d.; Monday, £26 1s. 3d.; Tuesday, £25 12s. 6d.; Wednesday, £25 16s. 3d.

Lead.—Home consumptive demand for soft foreign pig is again on a much diminished scale, and, with fairly heavy arrivals, prices have fallen slightly. The market here has benefited to a certain extent from Russian purchases, estimated at about 10,000 to 12,000 tons. Owing to the shortage on the Continent, about 9,000 tons of lead originally earmarked for shipment to this country has been diverted to Germany to replenish stocks.

The week's prices are appended:—

Soft foreign (prompt): Thursday, £20 8s. 9d.; Friday, £20 7s. 6d.; Monday, £20 6s. 3d.; Tuesday, £20 3s. 9d.; Wednesday, £20 7s. 6d.

Patent Specifications.

The following list of Patent Specifications Accepted have been taken from the "Illustrated Official Journal (Patents)." Printed copies of the full Specifications can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. each. The last numbers given are those under which the Specifications will be printed and abridged, and all subsequent proceedings will be taken.

13,725. Spence, J., Courtenay, C. E., and Courtenay, H. A. Method of and apparatus for the treatment of scrap containing gun metal and white metal in order to separate the latter. May 31, 1926. 276,730.

13,845. Wellman Seaver Rolling Mill Company, Limited, and Smith, S. Apparatus for pickling tubes, bars, etc. June 1, 1926. 276,732.

14,005. Sulman, H. L., and Picard, H. F. K. Treatment of tin ores. June 2, 1926. (Cognate Applications 31,530/26 and 5,231/27.) 276,743.

18,341. Linotype & Machinery, Limited, and Bugler, A. V. Apparatus for melting metal and casting it into ingots. July 22, 1926. 276,802.

20,883. Rennerfelt, I. Electric furnaces. August 24, 1926. 276,823.

25,029. Johnson, R. W., and Gray, J. Furnace firebridges. October 8, 1926. 276,848.

11,623. Meer, H., Meer, W., and Grüber, Dr. K. (trading as Meer, Geb.), and Grüber, Dr. K. Manufacture of metal tubes. May 3, 1926. 277,050.

14,860. Bower, A. S. Casting metals. June 12, 1926. 277,124.

15,188. Adam, M. A. Detinning of tinned iron scrap. June 16, 1926. 277,127.

18,321. Etablissements Sablyet. Electric furnaces. August 22, 1925. 257,237.

22,308. Kelly, T. D. Alloys. September 10, 1926. 277,170.

25,374. Marley, W. Hoppers for blast furnaces. October 12, 1926. 277,183.

29,499. Yoshikawa, H. Lead alloys. November 22, 1926. 277,199.

5,814. Fitzpatrick, H. D. (Marquette Tool & Manufacturing Company). Presses for drawing sheet metal. March 2, 1927. 277,231.

7,513. Miley, P., Haigh, E. V., and Hetherington & Sons, Limited, J. Metal boring and machining apparatus. March 18, 1927. 277,238.

11,115. Dowson & Mason Gas Plant Company, Limited, and Paton, J. Gas-fired annealing furnaces. April 26, 1927. 277,251.

14,135. Krause, R. C. Ingot moulds. May 26, 1927. 277,264.

14,613. Shaw, W. R., and Clarke, C. June 10, 1926. Apparatus for boring metal. (Cognate Application, 29,115/26.) 277,406.

14,959. Speichert, M. Process for treating lead-tin alloys derived from waste material. June 17, 1925. 253,908.

18,097. Martin W. E. Machine for grinding the surface of metal sheets. July 20, 1926. 277,464.

Mysore Ironworks.

The report on the working of the Mysore Iron Works for the year 1926-27, just published, states that the production during the year amounted to 20,055 tons. There has been also a marked increase in the yield of by-products, namely, acetate, alcohol and tar. The alcohol-refining plant and the pipe foundry started operation during the year, and have given satisfactory results so far. The costs of working have been brought down to an appreciable extent. Some improvement was also visible in the disposal of the products. A large amount has been spent in improving the equipment of the distillation plant, and a fund has also been accumulated to meet the cost of relining the furnace, which has run on its present lining for over four years. The report finally observes that the works have several natural advantages, and that the future can be faced with equanimity. The revenue and expenditure have balanced during the year.

40 Years' Experience in the Design and Construction of Fans

for

Heating and Ventilation of Buildings, Mines and Ships,
High Pressure Blast for Forges, Furnaces and Cupolas,
Mechanical Boiler Draught,
Fume and Steam Removal,
Dust Removal and Collection,
Cooling and Drying Plants.

means

Expert Knowledge, High Efficiency, Reliability and Good Service

Davidson's the TRADE SIROCCO MARK Fan Makers

have an experience covering hundreds of different industries and hundreds of different uses, and they can furnish a Sirocco Fan for every purpose for which a fan can be employed.

Solve your fan problems by using the Sirocco Service.

DAVIDSON & Co. LIMITED

SIROCCO ENGINEERING WORKS - BELFAST

LONDON · BIRMINGHAM · CARDIFF · BRISTOL · MANCHESTER · GLASGOW · NEWCASTLE

PIG IRON and High Grade CYLINDER IRON

For Motor Castings.

FOUNDRY & FURNACE COKE

J. C. ABBOTT & Co LTD

LLOYD'S BANK CHAMBERS, NEW STREET, BIRMINGHAM.
TELEPHONE: MIDLAND 170.

WEEKLY PRICE CURRENT.

COPPER.

	£ s. d.
Standard cash	58 15 0
Three months	58 15 0
Electrolytic	63 5 0
Tough	62 0 0
Best selected	62 10 0
Sheets	88 0 0
India	73 10 0
Wire bars	63 15 0
Do. November	63 10 0
Do. December	63 10 0
Ingot bars	63 10 0
H.C. Wire rods	68 5 0
Off. av. cash, Oct.	55 3 0⅝
Do. 3 mths., Oct.	55 5 3⅛
Do., Sttlmnt., Oct.	55 2 11½
Do., Electro. Oct.	62 8 9
Do., B.S., Oct.	61 18 9
Aver. spot price, copper, Oct.	55 2 11¾
Do., Wire bars, Oct.	62 12 4½
Solid drawn tubes	12½d.
Brazed tubes	12½d.
Wire	9½d.

BRASS.

Solid drawn tubes	11½d.
Brazed tubes	13½d.
Rods, drawn	10½d.
Rods, extd. or rlld.	7¼d.
Sheets to 10 w.g.	9¾d.
Wire	9⅛d.
Rolled metal	9⅛d.
Yellow metal rods	7¼d.
Do. 4 × 4 Squares	8d.
Do. 4 × 3 Sheets	8½d

TIN.

	£ s. d.
Standard cash	258 7 6
Three months	252 5 0
English	257 10 0
Bars	259 10 0
Straits	265 15 0
Australian	265 15 0
Eastern	255 0 0
Banca	267 5 0
Off. av. cash, Oct.	264 15 0⅜
Do., 3 mths., Oct.	261 16 4⅜
Do., Sttlmt., Oct.	264 14 9¼
Aver. spot, Oct.	264 15 0¾

SPELTER.

	£ s. d.
Ordinary	25 16 3
Remelted	24 15 0
Hard	20 0 0
Electro 99.9	30 0 0
English	26 0 0
India	22 0 0
Zinc dust	35 0 0
Zinc ashes	9 0 0
Off. aver., Oct.	26 15 3⅛
Aver., spot, Oct.	26 17 11¾

LEAD.

	£ s. d.
Soft foreign ppt.	20 7 6
English	21 15 0
Off. average, Oct.	20 14 3¼
Average spot, Oct.	20 9 7

ZINC SHEETS, &c.

	£ s. d.
Zinc sheets, English	35 0 0
Do. V.M. ex whf.	33 0 0
Rods	42 0 0
Boiler plates	30 10 0
Battery plates	32 0 0

ANTIMONY.

	£ s. d.
Special brands, Eng.	64 10 0
Chinese	43 0 0
Crude	37 0 0

QUICKSILVER.

	£ s. d.
Quicksilver	23 0 0

FERRO-ALLOYS AND STEEL-MAKING METALS.

Ferro-silicon—	
25%..	8 17 6
45/50%	12 15 0 to 12 17 6
75%..	20 0 0 to 21 0 0
Ferro-vanadium—	
35/40%	14/3 lb. va.
Ferro-molybdenum—	
70/75% c. free	5/- lb.
Ferro-titanium—	
23/25% carbonless	11½d.
Ferro-phosphorus, 20/25%	£17 15 0
Ferro-tungsten—	
80/85%, c. fr.	1/3 lb.
Tungsten metal powder—	
98/99%	1/8 lb.
Ferro-chrome—	
2/4% car.	£33 0 0
4/6% car.	£23 2 6
6/8% car.	£22 15 0
8/10% car.	£22 5 0
Ferro-chrome—	
Max. 2% car.	£35 17 6
Max. 1% car	£41 12 6
Max. 0.70% car	£52 17 6
70%, carbonless	1/4 lb.
Nickel—99%, cubes or pellets	£170 0 0
Ferro-cobalt	9/3 lb.
Aluminium 98/99%	£105 0 0
Metallic chromium—	
96/98%	2/11 lb.
Ferro-manganese (net)—	
76/80%, loose	£13 0 0
76/80%, packed	£14 0 0
76/80%, export	£12 0 0
Metallic manganese—	
94/96%, carbonless	1/10 lb.

Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL.

Finished bars, 14% tungsten	£0 2 6
Finished bars, 18% tungsten	£0 3 0

Per lb. net, d/d buyers' works.

Extras—	
Rounds and squares, 3 in. and over	4d. lb.
Rounds and squares, under ½ in. to ¼ in.	3d. lb.
Do., under ¼ in. to 5/16 in.	1/- lb.
Flats, ½ in. × ¼ in. to under 1 in. × ⅜ in.	3d. lb.
Do., under ½ in. × ¼ in.	1/-lb.
Bevels of approved sizes and sections	6d. lb.

Bars cut to length, 10% extra.

Scrap from high-speed tool steel—	
Scrap pieces	3d.
Turnings and swarf	1d.

Per lb. net, d/d steel makers' works.

SCRAP.

	£ s. d.	£ s. d.
South Wales—		
Hvy. steel	2 18 6	to 3 0 0
Bundled steel and shrngs.	2 12 6	to 2 15 0
Mixed iron and steel	2 12 6	to 2 13 6
Heavy cast iron	2 17 6	to 3 0 0
Good machinery for foundries	3 2 6	
Cleveland—		
Heavy steel	2 17 6	
Steel turnings	2 5 0	
Cast iron borings	2 2 6	
Heavy forge	3 12 6	
Bushelled scrap	3 2 6	
Cast-iron scrap	3 1 0	to 3 5 0
Lancashire—		
Cast-iron scrap	3 5 0	
Hvy. wrought	3 2 6	
Steel turnings	2 2 6	

London—Merchants' buying prices delivered yard.

Copper (clean)	50 0 0
Brass (clean)	38 0 0
Lead (less usual draft)	19 0 0
Tea lead	16 10 0
Zinc	16 10 0
New aluminium cuttings	77 0 0
Braziery copper	46 0 0
Gunmetal	47 [illegible] 0
Hollow pewter	170 [illegible]
Shaped black pewter	130 0

PIG-IRON.

(f.o.t. unless otherwise stated.)

N.E. Coast—	
Foundry No. 1	70/-
Foundry No. 3	67/6
Foundry No. 4	66/6
Forge No. 4	66/-
Hematite No. 1	72/6
Hematite M/Nos.	72/-
N.W. Coast—	
Hem. M/Nos. d/d Glas.	83/6
,, d/d Birm.	92/-
Midlands—	
Staffs. common*	—
,, No. 4 forge	62/6
,, No. 3 fdry.	65/-
Shrops. basic	—
,, Cold blast, ord.*	—
,, ,, roll iron*	—
* d/d Birmingham.	
Northants forge	55/-
,, fdry. No. 3	61/-
Derbyshire forge	60/-
,, fdry. No. 3	66/-
,, basic	—
Scotland—	
Foundry No. 1	—
,, No. 3	72/6
Hem. M/Nos.	76/-
Sheffield (d/d district)—	
Derby forge	66/-
,, fdry. No. 3	68/-
Lincs. forge	66/-
,, fdry. No. 3	68/-
E.C. hematite	85/-
W.C. hematite	90/6
Lincs. (at furnaces)—	
Forge No. 4	—
Foundry No. 3	—
Basic	—
Lancashire (d/d eq. Man.)—	
Derby forge	—
,, fdry. No. 3	74/-
Northants foundry No. 3	—
Dalzell, No. 3	100/- to 105/-
Summerlee, No. 3	89/- to 95/-
Glengarnock, No. 3	89/- to 95/-
Gartsherrie, No. 3	89/- to 95/-
Monkland, No. 3	89/- to 95/-
Coltness, No. 3	89/- to 95/-
Shotts, No. 3	89/- to 95/-

FINISHED IRON AND STEEL.

Usual District deliveries for iron; delivered consumers' station for steel.

	£ s. d.	£ s. d.
Iron—		
Bars (cr.) nom.	9 15 0	to 10 15 0
Angles		—
Tees to 3 united ins.		—
Nut and bolt iron		9 0 0
Hoops		12 10 0
Marked bars (Staffs.) f.o.t.		13 0 0
Gas strip		12 0 0
Bolts and nuts, ¾ in. × 4 in.		15 5 0
Steel—		
Ship plates	8 2 6	to 8 7 6
Boiler plts.		10 10 0
Chequer plts.		10 5 0
Angles		7 12 6
Tees		8 12 6
Joists		7 12 6
Rounds and squares, 3 in. to 5½ in.		7 15 0
Rounds under 3 in. to ¾ in. (Untested)		8 0 0 and upwards
Flats, over 5 in. wide and up		9 2 6
Flats, 5 in. to 1½ in.		8 2 6
Rails, heavy	8 2 6	to 8 7 6
Fishplates		12 10 0
Hoops (Staffs.)		10 10 0
Black sheets, 24g.		10 7 6
Galv. cor. shts., 24g.		13 15 0
Galv. fencing wire 8g. plain		12 10 0
Billets, soft	£5 15 0	to 6 10 0
Billets, hard		8 2 6
Sheet bars	£5 12 6	to 5 15 0
Tin bars	£5 12 6	to 5 15 0

PHOSPHOR BRONZE.

	Per lb. basis.
Strip	1 2¼
Sheet to 10 w.g.	1 2¾
Wire	1 3¼
Rods	1 2¾
Tubes	1 8
Castings	1 2

Delivery 3 cwt. free.
10% phos. cop. £40 above B.S.
15% phos. cop. £50 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. Clifford & Son, Limited.

NICKEL SILVER, &c.

	per lb.
Ingots for raising	9d. to 1/3
Rolled—	
To 9 in. wide	1/3 to 1/9
To 12 in. wide	1/3¼ to 1/9¼
To 15 in. wide	1/3½ to 1/9½
To 18 in. wide	1/4 to 1/10
To 21 in. wide	1/4¼ to 1/10½
To 25 in. wide	1/5 to 1/11
Ingots for spoons and forks	9d. to 1/5½
Ingots rolled to spoon size	1/- to 1/8½
Wire round—	
3/0 to 10 G.	1/6½ to 2/1½

with extras according to gauge.

AMERICAN IRON AND STEEL.

At Pittsburgh unless otherwise stated.

	Dols.
No. 2X foundry, Phila.	19.76
No. 2 foundry, Valley	17.50
No. 2 foundry, Birm.	17.25
Basic	20.00
Bessemer	19.76
Malleable	19.26
Grey forge	18.76
Ferro-mang. 80% d/d	90.00
Bess rails, h'y, at mill	43.00
O.-h. rails, h'y at mill	43.00
Bess billets	33.00
O.-h. billets	33.00
O.-h. sheet bars	34.00
Wire rods	43.00
	Cents.
Iron bars, Phila.	2.07
Steel bars	1.75
Tank plates	1.75
Beams, etc.	1.75
Skelp, grooved steel	1.75
Skelp, sheared steel	1.75
Steel hoops	2.30
Sheets, black, No. 24	2.90
Sheets, galv., No. 24	3.75
Sheets, blue an'l'd., 9 and 10	2.15
Wire nails	2.55
Plain wire	2.40
Barbed wire, galv.	3.25
Tinplate, 100 lb. box	$5.50

COKE (at ovens).

Welsh foundry	—
,, furnace	—
Durham and North.	
,, foundry	—
,, furnace	14/-
Other Districts, foundry	—
,, ,, furnace (basis)	12/-

TINPLATES.

f.o.b. Bristol Channel ports.

I.C. Cokes	20×14	box	17/7½
,,	28×20	,,	35/3
,,	20×10	,,	—
,,	18⅞×14	,,	—
C.W.	20×14	,,	16/7½
,,	28×20	,,	—
,,	20×10	,,	—
,,	18⅞×14	,,	—
Terneplates	28×20	—	per box basis f.o.b.

SWEDISH IRON.

Bars, hammered.	£18 10 0 to 19 0 0
Rolled Ord.	£15 0 0 to £15 10 0
Nail rods	£15 7 6 to £15 15 0
Keg. steel nom.	£33 to £35
Faggot steel nom.	£22 to £25
Blooms, according to quality	£8 to £12
Pig-iron	£5 15 0 to £6 0 0

all f.o.b. Gothenburg.

TUBES AND FITTINGS.

Up to and incl. 6 in.

	Tubes.	*Fittings.*
Gas	67½% ..	.. 45%
Water	63¾% ..	.. 40%
Steam	60% ..	.. 35%

W.I. 10% extra.

DAILY FLUCTUATIONS.

Standard Copper (cash).

	£	s.	d.		
Nov. 3 ..	58	12	0	inc.	15/–
,, 4 ..	58	5	0	dec.	7/6
,, 7 ..	58	10	0	inc.	5/–
,, 8 ..	58	15	0	,,	5/–
,, 9 ..	58	15	0	No change	

Electrolytic Copper.

	£	s.	d.		
Nov. 3 ..	63	0	0	inc.	2/6
,, 4 ..	63	0	0	No change	
,, 7 ..	63	0	0	,, ,,	
,, 8 ..	63	5	0	inc.	5/–
,, 9 ..	63	5	0	No change	

Standard Tin (cash).

	£	s.	d.		
Nov. 3 ..	259	10	0	inc.	25/–
,, 4 ..	260	10	0	,,	20/–
,, 7 ..	257	15	0	dec.	55/–
,, 8 ..	258	15	0	inc.	10/–
,, 9 ..	258	7	6	dec.	7/6

Tin (English ingots).

	£	s.	d.		
Nov. 3 ..	259	0	0	inc.	30/–
,, 4 ..	260	0	0	,,	20/–
,, 7 ..	257	0	0	dec.	60/–
,, 8 ..	257	10	0	inc.	10/–
,, 9 ..	257	10	0	No change	

Zinc Sheets (English).

	£	s.	d.		
Nov. 3 ..	35	10	0	dec.	10/–
,, 4 ..	35	10	0	No change	
,, 7 ..	35	10	0	,, ,,	
,, 8 ..	35	0	0	dec.	10/–
,, 9 ..	35	0	0	No change	

Spelter (ordinary).

	£	s.	d.		
Nov. 3 ..	26	6	3	dec.	3/9
,, 4 ..	26	6	3	No change	
,, 7 ..	26	1	3	dec.	5/–
,, 8 ..	25	12	6	,,	8/9
,, 9 ..	25	16	3	inc.	3/9

Lead (English).

	£	s.	d.		
Nov. 3 ..	21	15	0	dec.	5/–
,, 4 ..	21	15	0	No change	
,, 7 ..	21	10	0	dec.	5/–
,, 8 ..	21	10	0	No change	
,, 9 ..	21	15	0	inc.	5/–

BLAST-FURNACE STATISTICS.

Furnaces in Blast at the close of each Quarter making Pig-iron Specified.

Quarter ending.	Hematite.	Forge and foundry.	Basic.	Ferro-manganese	Total in blast.
1912					
March	16	26	7	6	55
June	103	163	47	12	325
September	113	170	49	15	347
December	115	171	49	15	350
1913					
March	118 2/3	169	52	18 1/3	358
June	117	163	50	14	344
September	107	157	47	13	324
December	91	154	55	13	293
1914					
March	96	146	47	11	300
June	90	143	45	12	290
September	94	133	41	15	286
December	100	136	46	12	294
1915					
March	102	130	52 2/3	10	294
June	103	126 1/3	54 2/3	10	294
September	105	117 1/3	52 2/3	11	287
December	108	111 1/3	50 2/3	15	284
1916					
March	116	106 1/3	50 2/3	12	285
June	120	106	54	13	293
September	124	107	58	13	302
December	126	110	57	18	311
1917					
March	131	111	62	16	320
June	129	116	70	15	324
September	123	102	78	19	322
December	118	99	85	13	315
1918	117	102	92	15	326
March	120	108	86	16	330
June					
September	120	104	83	14	321
December	113	108	72	15	308
1919					
March	98	109	69	13	289
June	97	107	78	7	289
September	66	99	53	5	223
December	77	113	62	8	260

Quarter ending.	Hematite.	Forge and foundry.	Basic.	Ferro-manganese	Total in blast.
1920					
March	92	108	72	10	282
June	97	119	68	12	296
September	93	122	73	12	300
December	77	125	59	13	274
1921					
March	36	70	10	3	119
June	—	1	—	—	1
September	17	41	10	—	68
December	22	41	15	3	81
1922					
March	31	46	23	7	107
June	25	55	28	9	117
September	27	74	27	10	138
December	46	83 1/3	30 2/3	10	170
1923					
March	52	93	45	10	200
June	62	103	45	13	223
September	38	98	42	11	189
December	50	99	49	9	207
1924					
March	45	94 2/3	51 1/3	10	201
June	45	91	46	8	190
September	44	85	38	5	172
December	42	87	31	7	167
1925					
March	40	84	36	9	169
June	31	76	32	9	148
September	28	67	30	5	130
December	38	74	32	4	148
1926					
March	39	79	33	4	155
June	3	5	4	2	14
September	1	4	—	—	5
December	24	33	20	2	79
1927					
March	50	86	39	7	182
June	46	86	36	10	178
September	41	78	36	7	162

WILLIAM JACKS & COMPANY,

WINCHESTER HOUSE, OLD BROAD ST., LONDON, E.C.2.

18, BENNETTS HILL, BIRMINGHAM.

18, BENNETTS HILL, BIRMINGHAM.
11, OLD HALL STREET, LIVERPOOL.
ROYAL BLDS., FISHER ST., SWANSEA.
FOWLERS BUILDINGS, BOMBAY.
CLIVE STREET, CALCUTTA.
20, SECOND LINE BEACH, MADRAS.
1, HONG KONG ROAD, SHANGHAI.

REGISTERED TRADE MARK

OCEAN BUILDING, SINGAPORE.
JAVA STREET, KUALA LUMPUR.
5, SHAFFRAZ ROAD, RANGOON
NADIR HOUSE, MACLEOD ROAD, KARACHI.
1 SHAREH SONK EL TEWFIKIEH, CAIRO.

PIG IRON

SCOTCH, MIDDLESBRO', HEMATITE, BASIC, SPECIALS, &c.,

NON-FERROUS METALS

COPPER, TIN, LEAD, SPELTER, ANTIMONY, CHROME ORE

WILLIAM JACKS & COMPANY,

19, ST. VINCENT PLACE, GLASGOW.

ZETLAND ROAD MIDDLESBROUGH

SMALL ADVERTISEMENTS.

Notice.

Small Advertisements in this section of the Journal are accepted at the prepaid rate of 6d. per line, first line in capitals counting two, average 6 words per line. Minimum charge for one insertion 3/-.

(A remittance should accompany instructions.)

SITUATIONS VACANT AND WANTED.

LADY SHORTHAND-TYPIST AND BOOK-KEEPER, thoroughly conversant with commercial side of Foundry practice, desires position in London Foundry Equipment or Supply Office.—Box "B. H. D.," Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

METALLURGIST, with 15 years' general Laboratory and Foundry experience, requires situation as Representative of Pig-iron and Steel Manufacturers; good knowledge of Iron and Steel Foundry work, together with Cupola and Converter practice.—Box 478, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

NON-FERROUS FOREMAN (35) desires change; able to design match-plates (cast), well up in mass production and conveyor systems for various classes of machines, large crank-cases particularly; American and Canadian experience, 1924-5; tactful in handling men; member of F.M.B.S.; strictly confidential.—Box 488, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

PRACTICAL AND TECHNICAL FOUNDRYMAN requires position, Manager or Foreman; skilled in Moulding Machines, Plates, Green, Dry, Loam and Oil Sands, any Metals or Alloys; quadrupled output last place, four years.—Box 494, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

FOUNDRY FOREMAN.—A vacancy is open for a practical and reliable man as Foreman in a modern Foundry in Eastern Counties which is producing a mass production line light cored and non-cored Castings in malleable and cast iron. Applicants must state full experience, giving in detail the class of work and the type of machine they have controlled.—Write, stating age and salary required, to "G. D.," c/o J. W. VICKERS & COMPANY, LIMITED, 24, Austin Friars, E.C.2.

THE STANTON IRONWORKS COMPANY, LIMITED, near Nottingham, require the services of an experienced Rate Fixer for Pattern, Moulding and Machine Shop Departments; experienced in the Rowan system preferred.—Apply, in writing, giving age and full particulars of experience, to the FOUNDRY GENERAL MANAGER.

AGENCIES.

ENGINEERING MERCHANT FIRM, having well-appointed Offices in Westminster, with qualified Secretarial and Technical Staff and Overseas Shipping connection, is prepared to act as London and/or Export Agents for a manufacturing firm.—Write, "T. J.," c/o J. W. VICKERS & COMPANY, LIMITED, 24, Austin Friars, E.C.2.

AGENTS ON COMMISSION, OR DISTRIBUTORS, wanted, all parts, calling on Foundries, for the Sale of "Metallic Phosphoro."—Write CHAS. HALL, 746, Seventh Street, Buffalo, N.Y., U.S.A.

BUSINESS FOR SALE.

THE PRINCIPALS of a well-known Foundry Equipment and Requisite Company are desirous of relinquishing their interests, and offer advantageous terms; the Company is a private limited one; payment can be spread over a period; reason for above, Principals retiring from Foundry business; the business offers splendid scope.—Firms interested should write, in confidence, Box 496, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

PROPERTY.

FOR SALE.

THE VALUABLE AND EXTENSIVE WORKS, SITE AND BUILDINGS,

Formerly used by J. Crowley & Company, Ltd.

AT MEADOW HALL, SHEFFIELD.

RAILWAY SIDINGS to L.M.S. and L.N.E. Rlys. Area about 11 acres, FREEHOLD. Works well situated and compact. Floor space about 145,000 sq. ft.

Full particulars and terms furnished on application.

THOS. W. WARD, LTD.,
ALBION WORKS, SHEFFIELD.

PATENTS AND TRADE MARKS.

THE Proprietor of British Letters Patent No. 223,720 for "Suspension means for Power Driven Mechanism for Breaking Metal, Rock or other Material," is desirous of negotiating with interested parties either for the granting of licences thereunder on reasonable terms or for the sale of the Patent outright.—Communications please address to DICKER, POLLAK & MERCER, Chartered Patent Agents, 20-23, Holborn, London, E.C.1.

MACHINERY.

MACHINERY PLANT, &c., FOR SALE.

HYDRAULIC ACCUMULATOR, 9¾ in. rams, 10 ft. stroke, 700 lbs. working pressure.

150-Ton VERTICAL HYDRAULIC FORGING PRESS; working pressure, 1,500 lbs.; ram, 19 in. diam.; stroke, 2 ft.

250-Tons POWERFUL HYDRAULIC PRESS, with 22-in. ram; working pressure, 1,500 lbs.; max. daylight, 5 ft.; min., 2 ft.

HYDRAULIC INTENSIFIER; large ram 8½ in. diam., small ram 2¼ in.: daylight, 20 in.; large ram 1,500 lbs., small ram 9 tons per sq. in.

Eight-ton STEAM DERRICK CRANE (Anderson); 55 ft. steel latticed jib; steel mast; vertical boiler, 7 ft. x 3 ft. 6 in., for 80 lbs. working pressure.

Three-ton STEAM DERRICK CRANE (Morgan); 59-ft. timber jib; steel mast; vertical boiler, 6 ft. 6 in. x 3 ft. 6 in., for 80 lbs. working pressure.

VERTICAL COCHRAN LAND-TYPE BOILER, for gas firing, 16 ft. 3 in. high x 7 ft. 6 in. diam.; working pressure, 80 lbs. per square inch.

LOCO.-TYPE BOILER, 10 N.H.P.; reinsure 150 lbs. pressure.

20-H.P. Portable Engine and Boiler, by Rustons'; reinsure 100 lbs. pressure.

CATALOGUE (10,000 Lots) ON APPLICATION.

THOS. W. WARD LTD.,
ALBION WORKS, SHEFFIELD.

SAND MIXERS.—New and second-hand. Ask us to quote.—W. BREALEY & COMPANY, LIMITED, Prospect Works, Hawksley Avenue, Sheffield.

ROOTS BLOWERS, two for Sale. One 6 in. and one 7 in., by Alldays & Dempster; in excellent order; cheap.

One belt-driven FAN, 12¾-in. outlet.

One belt-driven FAN, 7¾-in. outlet.

For further particulars, write GRAHAMSLEYS, LIMITED, Newcastle-on-Tyne.

30 CWTS. ELECTRIC FURNACE for disposal, complete with Transformers and necessary Gear.—Apply, Box 498, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

ONE 6-ton FOUNDRY LADLE, with worm tilting gear, can be adapted for bottom pouring.

One 15-ton FOUNDRY LADLE, for bottom pouring.

One VERTICAL HYDRAULIC BAR SHEARING MACHINE, to shear up to 4-in. square in copper and up to 2-in. square in mild steel, complete with belt-driven Hydraulic Pump.

One 10-ton capacity Morris CHAIN LIFTING BLOCK, with geared travel; very little used.

One 12-ton capacity OVERHEAD TRAVELLING CRANE, hand operated, 24-ft. 6-in. span.

For further particulars, write GRAHAMSLEYS, LIMITED, Newcastle-on-Tyne.

MACHINERY.—*Continued.*

FOUNDRY LADLES, ETC., FOR SALE.—All the Plant, including Testing Machine (by S. Denison & Son, Ltd., Leeds), one 12-ton Geared Crane Ladle (by Thwaites Bros.), one 8-ton, and one 1-ton Geared Crane Ladles (by Jas. Evans), one 20-ton Balance Weighing Machine (Avery); all lying at Collingwood Foundry, North Shields.—Apply T. E. ROWELL, F.C.A., 1, Northumberland Place, North Shields.

TWO LITTLE-USED ROTARY CORE-FORMING MACHINES; British, 14 sizes, cores up to 2 in.; American, 36 sizes, up to 2½ in.; perfect working order; very cheap.—Apply Box 490, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

MISCELLANEOUS.

PATTERNS.—Inquiries solicited; quotations by return; shop equipped with modern machinery; quick delivery.—CLEGHORN & COMPANY, Midland Pattern Works, Spring Gardens, Worcester. 'Phone 264.

CHARCOAL.—Powdered, granulated, lump, blacking; inquiries invited.—J. BUCHANAN & COMPANY, Ashfield Road, Altrincham, Cheshire.

PARTING POWDER.—Have you tried ours? Efficient and cheap.—WM. OLSEN, LTD., Cogan Street, Hull.

MAUGHLIN PATTERN LETTERS AND FIGURES.—Die cast complete with pins in one piece, ready for fixing; no shellac required; simply drive them in and they will not come off; send for samples and prices.—A. LAKIN & SON, Totley Rise, Sheffield.

FOUNDRY BARROWS (New and Second-hand).

ALL STEEL BARROWS, 2 Wheels.
19 Barrows, holding 12 cwts. Flue Cinder.
16 Barrows, holding 17 cwts. Flue Cinder.

FOUNDRY SHOVELS:—

39—No. 8 Type.
23—No. 12 Type.

JOHN CASHMORE, Great Bridge, Staffs.

RYLAND'S DIRECTORY

A new issue of this standard work of reference covering the Coal, Iron, Steel, Tinplate, Metal, Engineering, Hardware and Allied Trades is now in preparation.

NOW is the time to book space for your advertisement and to order your copy.

Full particulars and rates on application to the Advert. Manager.

INDUSTRIAL NEWSPAPERS Ltd.
49, Wellington St., Strand, London, W.C.2.

'Phone: 287 SLOUGH.

MOULDING MACHINES

OSBORN No. 403 Turnover 40×30 Jolter ..	£160
TABOR 14×16 Split Pattern Power Squeezer	£60
TABOR 30×20 Plain Shockless Bumper ..	£20
TABOR 72×50 Plain Shockless Bumper ..	£200
MUMFORD 18×12 Power Squeezer ..	£45
MUMFORD 36×24 Plain Bumper	£28
TWO FARWELL Squeezers, complete ea.	£12
FOUR Darling & Sellars 32×20 Turnover..	£12
ONE OSBORN Portable Plain Squeezer ..	£18

LARGEST STOCK OF FOUNDRY PLANT IN ENGLAND. PLEASE SEND FOR LISTS.

BUY FROM ME AND SAVE MONEY.

ALEX. HAMMOND, *Foundry Machinery Merchant.*
14, AUSTRALIA ROAD, SLOUGH.